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GAS LIGHT JOURNAL
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Improving Operating Conditions in Small Plants.

[Prepared by MR. MARSHALL MILTON, for the Sixth Meeting, Pennsylvania Gas Association.]

Until recently most small works have been owned and operated by local capitalists, and in most cases they did not appreciate true economy. The help they employed was untrained, and the apparatus was either out of date or inefficient. This was often due to the local financiers not keeping up with modern-day practices and thinking that true economy was in saving the dollar and not in providing up-to-date machinery or in employing at least one trained man.

They did not believe in, and would not spend $1 with the hope of getting back $2 in the future. Their motto was, "A bird in the hand is worth two in the bush."

The outcome of this precedure was that a great many small plants were inefficient, thereby producing high operating costs, poor service, dissatisfied consumers, low sales per customer, and as a result, poorer returns in dividends. This likewise worked a hardship on neighboring companies, who were operating efficiently, and left a sore spot to heal for the man who took hold of these companies later to operate; and even with efficient handling they have not gotten back altogether what their predecessors lost.

Before taking charge of a small plant, I had been employed with a large corporation, where each department was specialized and where the duties were more or less confined to one phase of the business. I had been used to having a clerk to call on in my own department, and the knowledge of the other department to help out in case I got into trouble. I did not realize that it was a big undertaking to jump from a big corporation to a smaller company, where you have to be the thinker for the whole establishment, and for the first 4 or 5 months I was lost to know what to do. After many sleepless nights, I decided that the only way I could reorganize and build up this small company was to train efficient help. As I did not have the money to employ trained men, the only thing to do was to get the raw material and build up an organization. This is the first and most important thing in the economical operation of a small company.

No plant is too small, as some may think, to map out and plan a systematic organization. It is even more important than in the larger plants, for the reason that the smaller cannot afford to employ more than one or two trained men, they cannot specialize like a large corporation, with high-priced men at the head of different departments, and therefore it is necessary for the manager to build up an organization and gradually train the men to take the head of departments.

After having made out your organization plan, you should look up your men, study them, and find out what is your best material, get these men together and impress upon them the value of efficiency, loyalty and co-operation. Gradually increase the responsibility of each, and after you have tried them and found them capable, give them all the duties shown in the diagram. Give them a voice in everything pertaining to their respective departments, periodically have them meet and talk over each phase of business. Take them into your confidence at all times, and show them that they are a big part of the whole.

After you have mapped out your organization begin to work out an efficient plan for operating. Each department is a link in the chain and each link has to work efficiently or the whole breaks.

Manufacturing—By manufacturing I mean from the time the raw material is unloaded from the car until the gas is pumped into the holder, the finished product.

The manager should visit the plant at least once a day, keep in close touch with the superintendent, talk about each man with him, and when he sees that a man is improving and beginning to think for himself, take an interest in him, recommend books for him to read along his line, have him work out his own results, and, as a stimulant, advance his pay. But never give any employee more money with the hope of improving him. Wait until he improves and then raise his pay.

In a works putting out from 150 to 250 M. cubic feet of gas on a shift, one foreman or superintendent should be able to look after the manufacturing and part of the distribution system. During the winter months most all of this time can be put in at the plant, and at this time he should look forward to the time when he will be on the streets installing mains and services, and should train the gas maker so that while he is away the gas maker can run the plant as smoothly as if he himself was there.

Here is a diagram of the organization of a small company:

ORGANIZATION DIAGRAM.

GENERAL MANAGER.

Manager, New Business Dept.	
New Business.	*Shop.*
Solicitors Appliances Supplies Complaints Record of and completion of orders Office Sales	Employees Supplies Completion of Work Active Complaints Arc and Street Lamps

Secretary and Treasurer.	
Office Records Consumers' Ledger Record Clerk Sundry Sales' Records General Bookkeeper Meter Readers Records Stenographers	Collectors Meter Readers Sundry Sales Cashier

Superintendent.	
Mfg. Dept.	*Dist. Dept.*
Works Employees Material and Supplies Labor Expense Results	Mains, Services Employees Material and Supplies Labor Expense Results

In a small water gas plant two men, a gas maker and a fireman, should be able to do all the work, except in case of emergencies. The fireman should be trained as a gas maker, and the street and service men as firemen, so that when it is necessary to run more than one shift you will not have to work your one shift overtime. It is not good business to work a willing hand to death, and by providing for emergencies this can be avoided. The two regular men, by congeniality and by working together, should accomplish everything around the plant under ordinary conditions.

The two men at our plant have the following duties:

When they come to work in the morning the fireman cleans out the boilers, shakes it down, wheels out the ashes and prepares the fire. While he is doing this the gas maker gets the generator ready to clean, measures his oil tanks, reads his station meter, takes the height of his holder and starts his daily sheet. By this time the fireman has finished with his boiler and they both jump in and clean the generator. After the generator is cleaned, and while the gas maker is blowing up his heats, the fireman pumps his drip, fills the coal cars and puts them on the coaling floor for the second coaling. After finishing the days run, both men get up enough coal on the floor for the first coaling the next day. I find it is best to let the unloading of raw material by contract, as it is much quicker and cheaper.

Somewhat similar conditions can be made in a small coal gas plant running from two to four benches, except that you have two regular shifts all the time. Three men should be able to take care of four benches, the figure generally used is one man to every nine retorts.

Preventing waste of the raw materials from which we make gas is, next to labor, the most important item. Too many checks cannot be made by the manager and the plant superintendent on the materials used at the plant, when we realize that nearly half of the cost of the total operation is in plant materials.

Always make the superintendent or foreman responsible for his materials and results. Do not order material for him. Let him first understand that he should keep a minimum and maximum stock of a figure named, then let him put in his requisition to the office far enough ahead to always keep his minimum.

The manager should never send material into the plant unless the superintendent has been notified ahead. If this is done a great deal of responsibility will be taken from the foreman and he naturally will feel hurt.

See that the foreman himself examines all cars before and after unloading, noting the measurements and shortages, gravity and leaks. All materials should be checked from the car to storage and the oil should especially be watched.

A water gas plant running one shift, making from 150 to 250 M. cubic feet of gas should operate on the following material:

3¼ to 3½ gallons per M. for 21 candle power gas.
35 to 40 pounds generator fuel per M.
12 to 15 pounds boiler fuel per M.

But under untrained management I have known plants to make a poorer quality of gas and use over 4¼ gallons of oil, 45 to 50 pounds generator fuel and 25 to 30 pounds boiler fuel per M.

If you analyze this last situation you will find that it is mostly due to the slackness and carelessness of the plant men, not through maliciousness or ill-will, but because they have not been taught to take care of the small things. You will generally notice in a plant operating under these conditions, tools, fittings, and other things lying around the yard; the machinery knocking; steam leaks and a general careless look. These same men can be taken and by suggestions without any friction, be made to realize the importance of doing the small things right, and you will find that it will soon become a habit with them, and unconsciously in crossing the yard they will pick up scraps of paper and throw them into the boiler; and so if you do not train your men you must expect waste, and the result is that good money is going to be wasted through the stack valve, or deposited in seals, drips and the relief holder.

You should also watch your water gas tar and see if you are getting it all back. It is very valuable for burning under the boiler and at road building and for other purposes.

The amount of tar made depends on the grade of oil used. On a light Pennsylvania oil 38° to 40° Baume gravity, you will find very little tar, in our case not over 5 per cent. of the enricher used.

You should also see that the cinders and clinkers and ashes taken from the generator are screened and picked over, picking out the cinders for use in the boiler. The clinkers and ashes left can be sold in some towns for concrete mixing and filling in for new buildings.

In this same way coal and coke should be handled. Nothing should be too small to have your notice. The plant scales may be cheating you, or perhaps it is winter and the railroad weighs your coal in a car that is half full of snow. A good way to keep your stock of coal so that it will come out all right with the books is to set the scales to weigh a little heavy, say 1 per cent., and when you see you are over, use this up and get credit for it in the next year. Gas works are generally built in a poor neighborhood, and you will have to watch out for what we call "coal pickers." Many plants have a night watchman when only running a day shift, but I think this money can be saved if you circulate through the neighborhood that you are watching your material, and that if any one is caught stealing you will make an example by an arrest. This has worked in our plant and my superintendent tells me that while these "coal pickers" are stealing coal from the railroad tracks and other places they always stay shy of the gas plant.

Careless charging of water gas machines and coal gas retorts can account somewhat for the high cost per M., but sometimes after this is corrected your conditions are still unbalanced. You should then look around and see if your capacity is large enough. Have you enough duplication of machinery so that you can lay off when the time comes to repair and still keep the holder full?

Now, as to purifying capacity. The general way of running in a small plant is to have four boxes with three on and one off. In our plant we have the boxes in the open, connected by a valve system so that they can be reversed and changed as we see fit. We run all four boxes at once. Every day the superintendent tests the last two boxes with lead acetate paper and as soon as we find the third box showing a discoloration he shuts off the gas and revifies the oxide in the box by pumping air through with an exhauster for about half an hour. He then purges these boxes with gas and puts them back into service. In doing this if you are using oxide made with iron fillings you will have to watch the temperature of the boxes and shut them off as soon as you see that the oxide is beginning to heat up. We have been very successful in handling the boxes this way, and it has been now nearly a year since the oxide was removed from any box. Another way that you can use in keeping the boxes clean is by reversing the flow of gas, making the first box the last box. Of course, after a time the oxide will become packed and show back pressure on your other apparatus. When this occurs the oxide will have to be removed and

revivified in the open air and fresh oxide put in the box. You may find, however, that your boxes have not capacity enough and that you are getting dirty gas in any case. You should calculate the capacity by allowing one cubic foot of gas to every foot of area per minute. If you go beyond this you will exceed the economical use of your oxide.

Water is another waste around the plant if you do not have an independent water supply. You can save here by stopping all leaks in the steam pipes, spigots, closets, etc. Also by circulating the water from the overflow of the tar separator through the wash box over and over again and by running the overflow from the condenser to your feed water pump and then into the boiler.

Now your machinery: Do not let it break down before it is repaired. There are two extreme stages of machinery, first, when it is in good shape, and second, when it is broken down. It is hard to tell much about the middle stage. You can, however, check up your engine and pumps by the use of an indicator, which will show you whether a valve is leaking or whether it is set right.

You should watch your boiler very closely for scale and see that the fireman blows the flues every day and gets out all the sediment in the mud drums. It is especially important that either the manager or superintendent go through the boiler with the insurance inspector when he comes and you should always be glad to see him, for most of these men are boiler experts and know their business.

Every works, no matter how small, should be provided with some testing apparatus, such as a calorimeter, CO_2 apparatus, and an improved jet photometer. If possible it should have a bar photometer, so that you will be able to calibrate your jet photometer periodically.

The jet photometer should be placed in the generator house so that the gas maker can always have it in view. Nothing is so injurious to your gas as CO_2, and you should try to keep it as low as possible. The gas maker can be taught to make his own CO_2 test, and also the use of the calorimeter and the bar photometer with a little instruction.

There are many more details in a manufacturing gas plant which I might touch on which lead to economy in operation, but I will have to pass on to distribution.

Distribution.—By distribution I mean the operating, both on the street and in the office, from the time the gas leaves the holder until it is used in the home, the store, the restaurant, the hotel or the factory.

As I explained in the diagram, I think the best way to divide the distribution in a small company is into two parts, letting the plant foreman take the services and mains, and the office the meters, appliances and complaints. If you have a regular new business man, besides a solicitor, it is best to place these last under him, because the shop is practically working for the new business department most of the time anyhow. If you only have a solicitor, the manager of the company can look after this work himself, by having a competent working head fitter in charge of the shop.

In the laying of services and mains, the most economical method is to be sure they are properly graded both in size and depth, looking forward always to the future growth of the city. See that the service mains are laid without traps. The depth will depend upon the depth of the frost line. All mains should be tested under pressure for leaks before covering up, especially carefully under paved streets. The proper installation of the work will insure economy in operation, future low leakage, few complaints and satisfied customers.

A recording guage, showing the pressure and the time, should be placed at different points in the town, according to the elevation, taking the high, intermediate, and low points. By adjusting the governor at the plant, you can carry practically a uniform pressure throughout the town, with your lowest point of pressure as a guide. I have with me pressure charts, showing how the pressure may be carried.

The proper setting, reading and recording of meters, which comes under the head of the office, is one of the most important duties of a gas company. Meters should be set in a dry place, preferably on a shelf in the cellar. Keep them away from the coal bins and as far to the front of the cellar as possible. Do not allow your meter to hang from the connections without any support.

A proper record of all meters should be kept, showing meter number, date set, date removed, and date tested. In setting and removing meters, be sure they are not placed on their sides, and in transporting them from place to place, it is well to have a rack on the side of your wagon or automobile truck, so that the meters will fit neatly. In this way there will be very little jostling. The meter readers should be impressed with the importance of accurate reading. Stress should be laid on the point that a wrong reading not only causes extra trouble and work in the bookkeeping department, but as bills are rendered to the consumer on the reading, if the consumer receives a wrong bill it will make him lose confidence in the gas company, and this will be the target for the chronic knocker to put up and knock down in every barber shop and saloon in the town, which will make many ignorant persons believe the gas company is crooked.

I am now coming to a department on which very little stress is laid in the average small company, and that is complaints. The manager should take more pains in training the clerk who receives complaints than any other employee in the company. Here you need tact, diplomacy—in fact every thing that goes to make up a diplomat and a statesman. In a small town the success of the gas company depends to a great extent on the sentiment of the public toward it, and this is governed largely by the company's methods, attitude or interest with regard to the public's needs. If the complaints are answered intelligently by a clerk and taken care of immediately, or as soon as possible, by a competent mechanic, you will soon find a number of boosters for you, and will see that it is just as easy to get boosters as knockers, if you cultivate them.

Do not stop after you have answered this complaint, but have a follow-up system. We have a follow-up system in the shape of a return postal card, as follows:

.....19

.....

.....

Dear Gas Consumer—

We were notified..... .....

that ... .

Our man has called, and we would ask that you advise us promptly on the attached postal whether or not your order has been attended to satisfactorily, if not we will give the matter our most careful attention.

Very truly yours,
(The Gas Company.)

..... 19

(The Gas Company):

My order referred to on your postal (has) (has not) been satisfactorily cared for.

REMARKS.

....
Signature.

Co. No.....
To..... .....
Name Address

If the consumer answers this unfavorably then it is time for the manager to get in himself.

We have used this system for over a year and the majority of our answers are expressed in favorable and appreciative terms.

Once in a while it is a good plan to have an extra stub on your gas bill and send it to each consumer. The stub we sent out last year was as follows:

COMPLAINT STUB.

Are your gas appliances and gas lights giving entire satisfaction?
If not please fill out this stub and send it to us.
Your co-operation will aid us in our endeavor to give.....
a service which for adequacy, efficiency and economy, is unequalled.

Please state complaint, if any.

(Additional space will be found on the back of this stub.)

In this way you will not overlook any one and will give everybody a chance to tell you what they think of your service.

If you do send out these notices be sure and take care of the answer, for if you don't you had better not send them at all.

There are a number of other things I would like to talk to you about, for instance, the Commercial Office and the Purchasing end, but I don't want to tire you out, so I will close by making a few remarks on the Sales Department.

You generally find competition more keen in small towns than in larger cities, but this should only push the gas man to more energy and keep him on the job. The manager has to put a great part of his time on the New Business end of the company, as his assistants are few. All companies, no matter how small, should have one good energetic solicitor with a thorough knowledge of house piping and gas appliances of all kinds, and a woman demonstrator who has been trained in a domestic science school. These two should work together making a house to house canvas at least twice a year, the solicitor calling on the demonstrator to help him out of a hole and *vice versa*.

The manager should get the plant men, the distribution men, the fitters and office men all working for the sale of appliances. This can be done in a number of ways. For instance, offer several prizes at different seasons of the year to those men who bring in the most sales or prospects for ranges and water heaters in spring and summer, and furnace water connections, lights and room heaters in the fall and winter. In fact, every man in the company might be classed as a salesman after it is all said and done. The whole business is a selling proposition, for unless we sell the gas there is no need of your plant, your distribution system or your office.

Now, as I said before, get all your men together at intervals and talk over the questions that come up in the different departments, give them their operating costs each month compared with the same month the previous year, have them analyze the increases and decreases in their respective departments, and once in a while show your appreciation by increasing their pay envelope. Let them see that they are getting credit for what they do. The whole success of this business is not in the manager, as a great many of us think, but in the efficiency, co-operation and loyalty of the organization. I lay more stress on the last requisite than any other, and there is a quotation on loyalty that I try to carry in mind, which runs like this:

"If all the the noblest attributes of men were gathered into one superheated crucible; if honor, integrity, reliability, courage, kindness, steadfastness, devotion, in short if all the qualities that make up manliness are reduced to a single essential there will remain in its fullest, finest and most beautiful form, LOYALTY."

Artificial Production of Coal.[1]

A process of decomposition occurring every day in nature on the largest possible scale is the decomposition of cellulose. This reaction is exothermic, giving off a large amount of heat. According to our experiments the reaction involves 70,000 grm. calories for each grm. molecule of $C_6H_{12}O_6$. This heat would suffice to raise the temperature of the reacting mass to about 1,200° C. provided none of the heat could escape. In nature the velocity of this reaction is so slow, that complete decomposition of cellulose in the form of wood or peat requires geological epochs till the end product of the process, our natural coal, is formed. Consequently the heat evolved during the reaction is conducted off quickly enough to prevent noticeable rise of temperature. To transfer this process of nature to the laboratory for study, means that this reaction must take place in hours or days, while nature can afford to take millions of years. The speed of reaction is easily increased by allowing the reaction to run at higher temperatures, but the large amount of heat generated has always caused superheating, which leads to more or less change of coal into coke. This has been the stumbling block of all previous laboratory attempts to obtain from natural products containing cellulose, a substance whose chemical and physical properties are identical with those of natural coal.

Leaving out of consideration those grades of anthracites which have an extraordinary high carbon content, we may say that coal calculated free of ash has a hydrogen value of not less than 4½ per cent. All artificial products of which analyses are at hand show a much smaller hydrogen percentage. This means that a secondary reaction has set in by which the coal has been partly changed to coke.

	Carbon, Per Cent.	Hydrogen, Per Cent.
Natural bituminous coal	75 to 90	4.5 to 5
Bergius and Specht	74.3 to 35.2	4.5 to 5.2
Stein	81.3	3.8
Klason	82.5	4.1

1. From "Journal of the Society of Chemical Industry."

This table gives a summary of recent experiments in this line. In spite of various precautions for preventing superheating, no one has succeeded in obtaining a product with sufficiently high hydrogen.

The equipment of our high pressure laboratory suggested the possibility of eliminating this source of error by allowing the reaction to take place in water kept in the liquid state by high pressure. Water penetrating the reacting mass must, on account of its high specific heat, be an excellent thermostat and prevent the dangerous local superheating by its good conductivity. A further great advantage for the study of the reaction itself lies in the absolute constancy and definiteness of the temperatures in question throughout the whole mass, enabling us to study the reaction at any desired temperature.

When subjected to this reaction at 340° C. for about 12 hours, pure cellulose yields a black powder, which proves to be soft coal of about 84 per cent. carbon, 5 per cent. hydrogen and 11 per cent. oxygen. At the same time carbon dioxide is evolved and is found under compression in the reaction vessel.

The substances found allows us to formulate the reaction about as follows:

$$4C_6H_{12}O_6 = C_{24}H_{10}O_4 + 3CO_2 + 12H_2O.$$

The heat of reaction can be calculated in the ordinary way and proves to be about 70,000 cal.

Experiments on Formation of Coal.

Material.	Temp. Degs. C.	Duration, Hours.	Analysis of Coal— C. Per Cent.	O. Per Cent.	H. Per Cent.	N. Per Cent.
Peat, original dry subst.	...	..	52.4	41.4	5.50	0.70
"	250	8	74.3	19.4	5.20	1.07
"	300	8	77.0	16.9	5.00	1.07
"	340	8	81.2	13.3	4.65	0.89
"	340	24	84.0	10.4	4.62	0.95
"	340	61	83.5	11.0	4.60	0.97
Cellulose	310	64	83.7	10.9	5.40	...
"	340	8	83.1	11.7	5.20	...

The table shows that the carbon percentage rises with the length of heating and the temperature. It reaches, however, a final value at about 84 per cent. carbon, beyond which it does not go, even after very prolonged heating. This substance therefore represents the stable end product of the voluntary reaction of decomposition. Further increase in the carbon value of natural coal cannot represent a further decomposition caused by the same reaction in still longer periods of time. This reaction evidently stops here, and only through reactions caused by new external conditions can the carbon percentage be raised further.

What has been said of cellulose is true of natural products containing cellulose, such as peat or wood. The chemical structure of the carbonaceous product is hardly affected. With an increase of bituminous matter the gas shows increasing amounts of methane, and the coal some additional hydrogen.

As mentioned above, the experimental methods employed allow not only excellent regulation but also a variation of temperature. It was therefore of interest to study the speed of the reaction at various temperatures in order to calculate from them the rate at which the reaction takes place in nature. Of course, the range of temperature in which such parallel determination is possible is naturally restricted. We have carried them through at 310° and 340° C.

The end product in both cases, whether heated for 64 hours at 310° or for 8 hours at 340°, is nearly identical according to the analysis.

A rise of temperature of 30° has accelerated the reaction eight times. Eight is two to the third power, an increase obtained in three times 10° rise of temperature. Consequently an elevation of 10° approximately doubles the speed of the reaction, and is the normal temperature co-efficient of a purely chemical reaction. Accepting this co-efficient we are able to calculate approximately how many years were required for the conversion of peat into natural coal.

On the assumption that the reaction took place at a normal average temperature of 10° centigrade, in accordance with the generally accepted theory of Potonie, we may say that for the formation of coal 87 per cent. carbon $2^{23} \times 8$ hours is the time required in nature. This is easily calculated to be about 8 millions of years. I give this figure with all due reserve, but it is probably correct as far as the order of magnitude is concerned. Geologists calculate this period to be several millions years, which is good enough agreement with the results of our chemical method.

The product obtained by this method has all the chemical properties of natural coal, analysis showing it has the required composition, and furthermore all the qualitative reaction demanded by Donath for fossil coal (Steinkohle) are fulfilled. The physical properties, however, differ widely from what we expect from natural coal. The new product is a very finely divided blackfish powder easily suspended in water. When heated to higher temperatures it resembles soot and might be used as a pigment.

It is, however, not impossible to convert this finely divided powder into a substance with all the physical properties of natural coal. This may be accomplished by a process probably analogous to that used by nature. It consists in heating the coal powder to above 300° C., and subjecting it at the same time to pressure, far beyond the few hundred atmospheres required during the reaction of carbonization. Both factors seem of equal importance, since at ordinary temperatures even the highest pressure at our disposal (about 5,000 atmospheres) have not been able to modify the chemical composition of the powder. To be sure, there results a coherent mass with the outer appearance of coal, having the proper specific gravity, but the chemical analysis shows that the carbon content has not changed. If, however, the temperature during compression is again raised sufficiently high to allow the chemical processes to take place within a few hours, that is, if we raise the temperature during compression to about 340° C., an entirely different product results. We assume in this case that the extremely high pressure forces the substance to undergo a new reaction, which has nothing to do with the reaction of carbonization found before to run on its own accord in the laboratory as well as in nature. The new reaction raises the carbon value of the coal, causing it to resemble more and more the natural anthracite; with strata at right angles to the direction of compression, and with specific gravities increasing according to the temperature employed and the duration of compression.

Leaving out the effect of temperature, which was merely a means of accelerating in the laboratory the slow process of nature, we find for the effect of pressure perfect analogy in our natural coal fields. Whenever we find fields that have been subjected to compression as a result of an upheaval of the surface layers, we may safely count on an increased carbon content of the coal, and a conversion into anthracite.

Our experiments therefore justify us in saying that the formation of coal in nature takes place in two distinct reactions; first the reaction of carbonization, and secondly the formation of anthracite. The former represents to the physical chemist a reaction progressing on its own accord under ordinary presure. The latter cannot take place under ordinary pressure, no matter how long we wait. Increased pressure alone is capable of forcing the chemical system to undergo a change in the direction of increasing the percentage of carbon. In both cases rise of temperature merely hastens the reaction, which goes on just as well at lower temperatures. Here there is a difference of highest significance between the effect of temperature and that of pressure. Without the latter no formation of anthracite can occur. Thus we see that it is not proper to attribute to anthracite in every case greater age than to ordinary coal. Most anthracite dates from a very early period, but ordinary coal may be just as old, if not older. It remained ordinary coal because sufficient pressure was not at hand to cause the transformation.

This explains why anthracite is often found in strata, which are geologically of recent date, while in paleozoic strata coal has often been found with a carbon content lower than that of coal in mesozoic strata.

I have tried to give a short survey of the lines followed in the high pressure experiments in my laboratory. Such experiments have not merely as their aim the solution of technical problems, but lend themselves to the solution of purely scientific problems as well, for the prodnct obtained by the artificial carbonization of cellulose lays no claim to being a substitute for natural coal, and there seems little hope to rival nature in this process with equal efficiency. At any rate, while our mines are still productive, it is cheaper to rely on nature's storehouse. Perhaps, in years to come, when this happy condition has ceased, the study of the process of carbonization may have more than scientific interests, and may serve as a basis for methods of supplying indispensible coal. We may not be far from this point, since some endeavors seem very promising, especially those of obtaining coal from peat by wet carbonization, according to the process of Ekenberg and Testrup.

If you ask what has enabled us to make these high pressure experiments almost as conveniently as in ordinary test tubes and flasks, the answer is our ability to join tubes and bombs, with each other and with measuring apparatus, without danger of leakage, even at pressures as high as 400 atm. and at temperatures up to 500°. These air-tight joints, first employed by Haber and Le-Rossignol, rests upon a union of two parts closing upon each other, not with an extended surface, but in a circular line of contact between cone shaped ends of the parts to be joined.

These two cones are clamped and forced together by a screw. Expansion on heating does not cause leakage, because the parts expand equally. The same method is employed for closing up the reaction vessels. We have used such cones as large as 20 centimeters in external diameter with excellent results, at pressures up to 400 atm. They offer not only a very convenient means for joining and closing up tubes and bombs, but they show little deterioration in use. Moreover, they may be used in large number in the same apparatus without difficulty. In our experiments we have used as many as 20 joins in one apparatus, heated to 400° at 150 atm., and three weeks after no decrease of pressure could be detected.

For small laboratory experiments we employ hollow steel blocks. A small hole on the side gives room for a thermo-element for controlling the temperature. This is the cone which is tightened by means of a screw. The core has a tube by which valves or gas bottles may be attached to the vessel. For regulating and reducing the pressure, and for closing off tubes, we use the LeRossignol valve. With an increase in the size of the apparatus, it is advisable to use large flasks of pressed steel, made according to the Ehrhardt method. I have used those flasks with a capacity of 12 gallons, but they can easily be made to hold up to 200 gallons. For the general introduction of high pressure methods into chemical industry, we feel assured that no insurmountable obstacles will present themselves as far as the construction of the necessary apparatus is concerned.

Welfare and Safety Provision at the Welsbach Company's Plants.

[From paper by HOWARD LYON, read before Americon Institute of Chemical Engineers.]

Some seem not to be satisfied with an account of the welfare work of corporations unless they are assured that this activity originates from altruistic motives. Our welfare effort was partly prompted by statutes, and further by considerations of profitable business, and with the work well under way, we are convinced that humane treatment of employees is as good business for corporations as for individuals employing labor.

Welfare work now in force with the Welsbach Company has accomplished in large measure the following results:

1. Safe conditions of labor.
2. Fire protection.
3. Measures for the health of employees.
4. An Employees' Relief Association.
5. Provision for aesthetic and cultural betterment.

It may be seen that these results, in the order named, are increasingly farther removed from justification by purely business considerations, but the world's experience has proved that the human machine works efficiently only under the impetus of treatment that is just, kind and considerate.

The Welsbach Company has elected to assume the liability imposed by the New Jersey and Ohio State laws relating to injuries incident to service, and naturally has sought to minimize its money obligation by providing every possible means of avoiding accidents.

Guards, cases, or gratings protect the fingers, arms and clothing from being caught by gears, saws, belts, punch presses, knives and shears. All grinding wheels are encased to safeguard from flying fragments. Buffers in continuous use have the dust exhausted by suction fans, and workers are snpplied with face hoods, equipped with wet sponges, for the nose. Punch presses cannot be operated except with the two hands in positions of safety. Exhaust hoods carry off vapors from noxious acids. Mantles are dried, after collodionizing, in closed chambers, the heavy vapors of wood alcohol and ether carried downwards. Eyes are shielded from glare in hardening mantles by plates of blue glass. All stairways, elevator shafts and dangerous passages are guarded by rails. Trenches are guarded by rails and at night by lanterns. Everywhere are notices that safety appliances must be used, and that guards must not be removed.

When a man prepares to go into a boiler, to clean or inspect it, he

draws the fire and closes and locks the outlet steam valve, the inlet hot water valve, the blow-off valve and the flue damper. *He enters the boiler with the locking keys in his pocket.* Rubber gloves, aprons, boots and coats are furnished to operators or workmen who might be injured by chemicals or water. Caps are provided if the hair is liable to be caught. Places subject to fire or explosion from combustible gases are lighted with closed lamps.

A Pulmotor is owned by the company and is offered for use to all local physicians free of cost.

Our liability under the law last year amounted to about $700. Without our present safety devices and precautions, insurance covering these risks would have amounted to $2,600. We have gained amply by our expenditure, and our employees have been able to earn full pay for a larger proportion of their time, and possibly even their lives have been saved.

Our company is in sympathy with the liability law. By assuming liability, fees and costs are saved both by the company and the injured party. Both parties fare better under the policy of self-protection than through outside insurance.

A recent accident case will illustrate this point. Some weeks ago a boy slipped from an elevator and was forced back against the walls of the shaft and pretty severely mangled. The company had him removed to the hospital immediately. As the seriousness of his injuries became apparent, he was taken out of the public ward and put into a private room. One, and at times, two special nurses were employed to attend him. He was cared for and operated on by a skilled surgeon, not of the house staff. Under this treatment the boy fared splendidly, and has now been discharged from the hospital. An insurance company would undoubtedly have left the boy to the tender mercies of the public ward, where his chances for life would have been much smaller. The humane treatment of the case meant life to the boy and *actual money saving to the company.*

In the branch factory at Columbus, O., we insure with the State Liability Board of Awards, because the board may be expected to assume a humanitarian policy.

All buildings occupied by our company are equipped with automatic sprinklers with ample power to maintain pressure with hose lines in use. Our system furthermore is connected with a similar system of the adjacent Argo Cotton Mills and with city mains. Hose houses at all important points outside the buildings are supplied with hose, axes, bars, wrenches and extra nozzles. All hydrants are inspected weekly and fire drill is carried out every Saturday afternoon. In case of fire every man knows his place. There are at least two exits from all factory rooms. Fire danger to operatives is small, as the buildings are not over two stories. A night force of at least ten men is ready for action as protection is important also at night, for a destructive fire would deprive employees of their employment and income.

Provision for safeguarding the health of employees is ample and somewhat exceptional in its scope. A limousine and open car are on call constantly to convey any injured or ill person to the hospital or home. We have in our own enclosure a hospital with an attendant trained nurse and all the means for first aid treatment. A salaried physician is in daily attendance to respond to calls at any time.

Employees whose work subject them to exceptional danger are examined to determine their physical fitness for that work. For instance, where there is danger of injury to the eyes, only those whose eyesight is perfect are engaged for the work. In one respect our provision for the health of employees is unique. Any employee either at the works, at the physician's office or at his own home, may get advice, medicine or treatment free of charge. A dispensary at the hospital supplies free medicines for temporary ailments.

Fans are employed to bring cool fresh air into our hardening rooms, as these rooms are subject to excessive temperatures and vitiated air by the burning off and hardening processes. There are also conveyors of fresh air at the machines of individual operators.

Shops and other rooms where the ventilation conditions are more nearly normal are provided with roof or ceiling ventilators.

During the past year an Employees Relief Association has been formed with a membership of about seven hundred. The treasurer of this organization is paid a salary by the company to give his attention to collections of fees and disbursement of relief funds.

The following table gives the classification of risks as based on earnings and benefits in sickness or death.

Our company is also constantly expending money to make the plant attractive to the social and aesthetic sense of its workers. We have large stretches of well kept lawns broken by rare trees and shrubs and beds for a succession of flowers. The artistic gateway, paved driveways, concrete walks, vistas of beautiful grounds and ivied walls give the appearance of a public park rather than a place where human toil is turned to profit.

Class.	Weekly Pay.	Weekly Fee.	Benefits.
A.....	$5.00 or less	5c.	$2.50 per week for 13 weeks, or $50.00 at death.
B.....	$5.00 to $10.00	10c.	$5.00 per week for 13 weeks, or $75.00 at death.
C.....	Over $10.00	15c.	$7.50 per week for 13 weeks, or $100.00 at death.

One attractive building serves the double purpose of hospital and club house for the women employees. It is comfortably and attractively furnished and has a lunch room in the basement where tea, coffee and milk are supplied at 2½ cents per glass. The management of the club house is vested in an organization of women workers and the rooms are open during the day and also in the evening by permission conditioned on the presence of some responsible matron. In the latter case young women are privileged to entertain their men friends.

The nurse of the hospital adds the refining influence of a rare personality to the experience of the young women, and young women are constantly coming to her for counsel.

Something is being considered in the way of providing a similar club house for the male employees, with lunch room and smoking room. A fine tennis court has been laid out for the use of employees during the day or in the evening, and is largely used.

A measure recently put in force is significant and instructive to those who dwell upon problems of efficiency in industrial work. At the middle of the morning and afternoon work periods, 400 or 500 girls and women employed in mantle operations are given a rest period of 5 minutes for relaxation and fresh air. This measure means a mathematical loss of service amounting in the aggregate to about $2,000 per year, but experience up to the present time indicates a gain rather than a loss by reason of a fresher spirit for exacting tasks.

Large Capacity English Turbo Exhauster.

This fan type exhauster in the Windsor Street Gas Works, Birmingham, England, is described by Mr. John Foster in *Journal of Gas Lighting.* The steam turbine driven exhauster set was made by the British Thompson-Houston Company, guaranteed to handle 500,000 cubic feet of coal gas per hour, and capable of giving 18 inches suction water gauge, and discharge up to 40 inches water pressure; vacuum not to vary more than $\frac{1}{16}$ inch, irrespective of variations in quantity of gas delivered (Fig. 1).

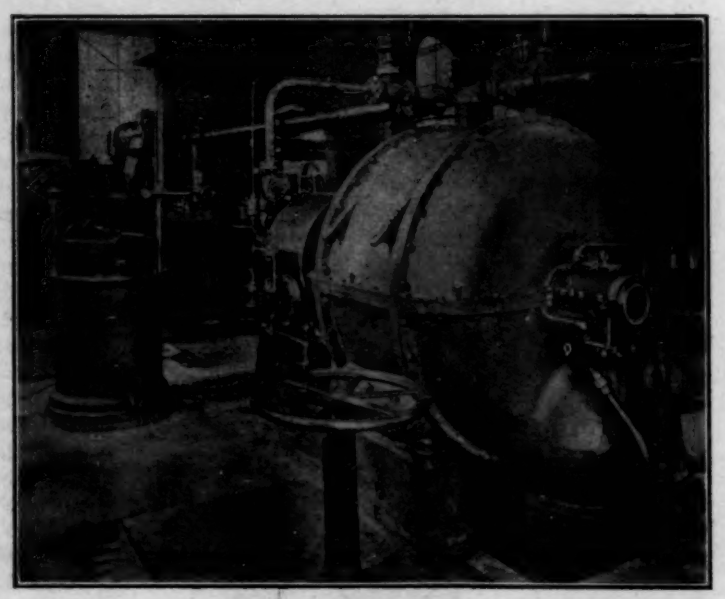

Fig. 1.

It consists of a Curtis impulse type turbine connected by flexible coupling to a two-stage rotary exhauster on same bed plate, and runs at normal speed of 3,600 revolutions per minute.

The vacuum regulation is by a Waller float governor on the suc-

tion of the exhauster, controlling the steam throttle to the turbine. The exhauster has two impellers connected in series, back to back, in order to obviate end thrust. Suction and delivery connections are on the under side of the casing, which can thus be opened for examination without breaking any pipe joints. Fig. 2 shows the ex-

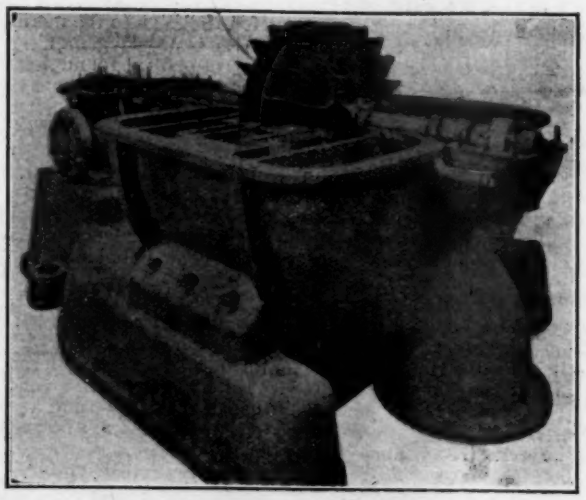

Fig. 2.

hauster with the top half of the casing removed and the rotating portion in position. Fig. 3, the impellers, which are solid castings

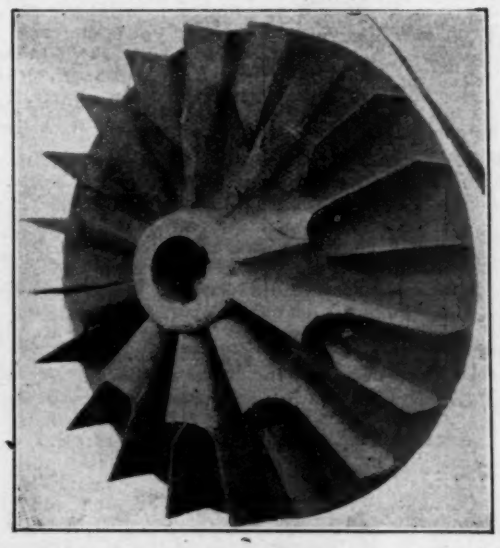

Fig. 3.

of special steel, with blades and hub in one piece except for the inlet ends of the blades, which, being twisted in order to give free entry of the gas, are mounted on a small extension hub. This solid impeller construction obviates the use of rivets as in the usual built-up design, and which are subjected to a shearing stress and corrosion.

On leaving the impellers the gas passes through a series of exit guide blades whose function is to convert the velocity energy into pressure energy. A diaphragm is fitted between the two impellers; and this carries a "B.T.H." patent yielding packing ring which prevents leakage from stage to stage. The shaft of the exhauster runs in bearings, one of which has thrust collars to maintain the correct relative position of the rotating and stationary parts. On account of the large quantity of gas and the consequent axial width of the impellers, the distance between the centers of the bearings is large, and the high speed renders it necessary to keep the critical speed of the exhauster below the running speed.

In order to damp-out any vibrations which may occur when passing through the critical speed when running up to speed, a special form of slip bearing has been adopted at the outboard end. It consists of an ordinary spherical bearing bush held in the pedestal by side cheeks, to which the flange on the bearing is held by bolts with spring washers. Any lateral vibration is thus damped-out by the friction of the bearing flange on the supporting checks. Water-sealed glands are provided, the paddles of which work against a head of some 10 feet. These glands prevent the escape of gas, and use but a small quantity of sealing water. There is no rubbing contact and therefore sparks cannot be generated and cause a possible explosion. The turbo exhauster has now been running very satisfactorily for 5 months. It adapts itself to any load, and there is no difficulty in maintaining a steady vacuum even when the output drops to 20,000 cubic feet per hour. The guaranteed steam consumption was from 3 to 5 per cent. less than the ordinary exhauster on the average full, half, and quarter loads, and our experience fully bears this out, and I estimate too that we shall save upwards of $800 per annum in lubricating oil.

The Possibilities for the New Business Man In the Field of Gas Illumination.

[Prepared for the New Jersey Gas Association by WILL W. BARNES.]

My desire is to endeavor to bring before you New-Business men the consideration of a more painstaking effort to hold the gas lighting business, which has been yours for so long, but which will soon be lost to your competitor unless aggressive methods are immediately taken.

The possibilities in the field of gas illumination to day, are so great and varied that to elaborate them at this time would necessitate more time than would be permissible at this meeting, It is hard to admit, but it is a noticeable fact, that gas consumers, as far as illumination is concerned, are growing fewer and fewer year by year. The proof of this comes from makers of lighting fixtures, as we are not manufacturing the quantity we formerly did, and the only answer to this condition is, "Lack of demand."

I say frankly, that, from a manufacturer's standpoint, as hard as we strive to construct fixtures that are modern and artistic in design, the gas fraternity, as a whole, are not very responsive in the merchandizing of the improved product. The question of price is considered too seriously, the thing which should be thought of last.

In selling gas for illumination, the first thought to have in mind, and a very interesting one, is the advantages of its use over any other illuminant. These advantages are interestingly told in a booklet on "The Hygenic Value of Gas Lighting," by Mr. R. F. Pierce, which is written in such form that any layman can absorb the very essence of it. Mr. Pierce says:

"Scientific experiments, carried out by investigators of unimpeachable standing, prove that gas lighting positively improves the air for breathing purposes, under actual conditions of use. The causes of this improvement are, the acceleration of ventilation; the destruction of disease germs; the addition of necessary moisture. Gas light is best for the eyes because it is soft and mellow and free from glare, and it does not contain the dangerous ultra-violet rays."

What more need be said in favor of gas for lighting? Having these facts firmly fixed in your mind, and with faith in your product, what are your possibilities? To my mind they are beyond estimation.

By way of comparison what are our electric friends offering in competition with us as to candle power? Look at this comparison:

	Consuming.	Gives.
Welsbach, Jr., light.....	1½ cubic feet.	50 candle power
Tungsten lamp.....	60 watt.	48 " "
Reflex burners.....	3½ cubic feet.	80 " "
Tungsten lamp.....	100 watt.	80 " "
No. 20 Reflex lamp.....	8 cubic feet.	250 " "
No. 10 Humphrey lamp..	8 " "	250 " "
Tungsten lamp.....	250 watt.	200 " "
4-mantle arc lamps.....	12½ cubic feet.	400 " "
Tungsten lamp..... ..	500 watt.	400 " "

Their comparitive cost needs no argument. Here are the 4 essential points to carry in mind: The hygenic value of gas lighting; its superiority in the matter of eye comfort; its increased candle power, and last of all, the cheapness in its use, a thing in my mind that cannot be dwelt upon too strongly.

The matter of heat from the use of gas need not be considered seriously, the one necessary thought to have in mind, is its convenience and artistic effects by its use. We, as manufacturers, have succeeded in overcoming the defects of bygone days in the matter of construction. The twentieth century fixture is a great innovation in comparison with the old-time product

I recently installed in two homes as gifts, semi-indirect gas fixtures, which have been the wonder of all who have seen them. I can

(*Continued on page* 298.)

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NOTICE TO ADVERTISERS.

New Advertisements and changes of copy therefor should be in hand Wednesday noon of week prior to date of issue.

NEW YORK, MONDAY, MAY 11, 1914.

DEATH OF THOMAS JOHN CUNNINGHAM.

"In the midst of life we are in death."

It is with a sense of personal loss that we make the sad announcement to the Gas Fraternity at large, to the members of all the Gas Associations, and intimate friends, of the passing over of our beloved Editor, companion and friend, Mr. Thomas John Cunningham, on Wednesday, May 6th, at 10:30 o'clock, after a brief illness, at his last residence, Clarendon Hotel, Brooklyn, N. Y. Deceased was born in Brooklyn, Nov. 11th, 1853, attended Manhattan Academy, 32d Street, during boyhood and entered upon the work of typesetter in a printing establishment in the late sixties, coming from the New York "World" office to the AMERICAN GAS LIGHT JOURNAL in May, 1870, as a printer. Advancing rapidly with pen and patience, he won for himself the position as Editorial Assistant to Mr. Joseph Russell Thomas, Jan. 7th, 1889, when the JOURNAL appeared for the first time as a weekly publication. And upon the death of Mr. Thomas, Nov. 28th, 1896, Mr. Cunningham became senior Editor, which office he has filled most acceptably. In May, 1903, he was elected an honorary member of the Western Gas Association. Always of a genial warm nature—"Our Tom," familiarly called by all his associates, drew around him congenial spirits who appreciated his clever Irish wit, his indominable fund of stories, and a receptive mind that never allowed a date or an incident, however trivial, to escape him.

From Mr. Cunningham's connection with Mr. Charles E. Sanderson in this office in 1870, there sprung an intimacy born of continuity, which ceased only when death claimed Mr. Sanderson, in 1907. Their natures widely diverging, each held the heart of the other in closest bond of fellowship. And now with fewer and fewer of the original band that loved each other, as men can love who have summered and wintered together, who have held heart to heart talks, though often differing in opinions, never allowed the sun to go down on their wrath, but loving each other as brothers, forgot their differences and separated, as friends. To us, who knew Mr. Cunningham well and loved him for himself alone, there falls a shadow over our path that dims our eyes and leaves us deeply mourning our loss.

He was one of the fast dwindling "Old Guard" of the gas fraternity, and those who knew him best realized his wonderful power in making and holding friends.

He probably knew and was known by more gas men than falls to the lot of most anyone.

From the scores of messages and telegrams of loving sympathy and admiration we realize the enormous extent of his acquaintance covering this country and Europe, and the personal hold he had on men of learning and appreciation of those sterling qualities which had been meted out to him in double measure. Sadly missing him from our own ranks, we know that our loss is his eternal gain.

"Now the laborer's task is o'er,
Now the battle day is past;
Now upon the farther shore
Lands the voyager at last.
Father, in thy gracious keeping
Leave we now Thy servant sleeping."

He is survived by two maiden sisters, the Misses Margaret and Katherine. Funeral services were held in St. Francis Xavier's Church, Brooklyn, at 10 o'clock, Friday, May 8. Interment in Flatbush Cemetery.

[redacted]

SAMUEL LINDSAY WARD, for 25 years a valued and able compositor in the employ of the AMERICAN GAS LIGHT JOURNAL, died on May 5, 1914, at his late residence, 434 West 38th street, after a lingering and painful illness. Interment in Woodlawn.

[redacted]

[OFFICIAL ANNOUNCEMENT.]

Tenth Annual Meeting, Iowa District Gas Association.

IOWA DISTRICT GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
DES MOINES, IA., April 18, 1914.

The tenth annual meeting of the Iowa District Gas Association will be held in Davenport, Ia., May 27th, 28th and 29th. The headquarters of the Association will be in the Kimball Hotel. Members are urgently requested to make early reservations. Mr. H. J. Carson, General Superintendent, Muscatine Lighting Company, is Chairman of the Committee on Arrangements, and will make reservations on request or furnish any other information desired. The following papers will be presented at the meeting:

"Circular 32 and the Report of Committee on Thermal Value and Candle Power made to the New York State Public Service Commission, Second District," by Mr. Austin Bush.

"Tar," by Mr. Alfred Hansen.
"The Storeroom," by Mr. Geo. G. Kuhn.
"Domestic Appliances," by Mr. C. W. Lockwood.
"The Elements of Gas Rate Making," by Mr. Henry I. Lea.
"Some Distribution Experiences," by Mr. W. H. Merritt.

The attention of the members of the Association is called particularly to this list of papers, which embody the most vital subjects before our industry to-day. In addition, the following standing committees will report: Manufacturing, Distribution, Construction, New Business and Public Relations. One whole day of the meeting will be held on board the Mississippi river steamer, "W. W." Other interesting entertainment features are being arranged.

G. I. VINCENT, Secretary.

[OFFICIAL.]

Thirteenth Meeting, the Wisconsin Gas Assocciation.

WISCONSIN GAS ASSOCIATION,
OFFICE OF SECRETARY,
MILWAUKEE, WIS., April 16, 1914.

To the Members of the Wisconsin Gas Association: The Thirteenth Annual Meeting of the Wisconsin Gas Association will be held in the Hotel Pfister, Milwaukee, May 13th and 14th, 1914.

Aside from the fact that a number of interesting papers and addresses will be presented, other matters, of vital importance to the welfare of our organizalion, are in contemplation, the best and final solution of which can be arrived at only after careful and thorough consideration. The Wisconsin Electrical Association is expected to make overtures at this meeting asking consideration of the subject of combining with the Wisconsin Gas Association, and a com-

mittee, representing our organization, consisting of Messrs. W. E. Haseltine, R. B. Brown and Robert Young, has already been appointed by the President to give the matter some thought before the meeting. It is also quite probable that a request from gas men in Minnesota, to take in their territory into a joint Wisconsin and Minnesota Association, will be up for consideration.

In order to have the action of this meeting on both the subjects, as nearly as possible, representative of the unanimous sentiment of our organization, the fullest possible attendance is absolutely imperative.

Of the papers to be presented, we now have definite promise of one by Mr. Halford Erickson, of the Wisconsin Utility Commission, on "Depreciation;" one by Mr. C. R. Phenecie, of Green Bay, entitled "Some Points of Interest on High Pressure Gas Submarine Crossings;" one by Mr. D. G. Stroebel, of Ft. Atkinson, on "Equipment of Domestic Science Schools;" "Intensive Methods of Selling Water Heaters," by Mr. R. O. Jasperson, Milwaukee; "Measuring Gas in Large Quantities," by Mr. J. A. Wilson, Milwaukee; another paper, by Mr. R. C. Cornish, of Philadelphia, the subject of which has not yet been announced; a lecture, illustrated by motion pictures, showing "Modern Methods of Manufacture of Steel Pipe," by the National Tube Company; and one similarly illustrating the "Manufacture of Gas Ranges," by the Detroit Stove Works. In addition to the above other papers are still under negotiation.

Then there is the entertainment, to which the first evening of our convention will be devoted, and for the quality of which those in charge do not expect it will be necessary to make apology. Taking it all in all, the inducements are there for a record-breaking attendance; and, in anticipation thereof, I beg to remain,

Yours truly,

HENRY HARMAN, Secretary.

BRIEFLY TOLD.

NEW JERSEY STATE GAS ASSOCIATION.—The Spring Quarterly Meeting of the New Jersey State Gas Association, was held at New Brunswick. John A. Clark, Jr., Engineer of Distribution of the Public Service Gas Company, at Newark, was the chief speaker, his address covering the efficient administration of the operating department as an aid to new business. Papers were read by Will W. Barnes, of Brooklyn, who pointed out the possibilities of gas as an illuminant, and George L. White, of the Public Service Gas Company, Jersey City, on "Collections." Others who spoke were S. P. Zingg, of Montclair; J. P. Hanlon, of Newark; Charles W. Hoy, of Glassboro; B. K. Johnson, of Gloucester; R. H. Garrison, of Atlantic Highlands; S. J. Franklin, of Millville; R. R. Young and Ormsby F. Potter, of Newark; and P. S. Young, President of the National Commercial Gas Association. These officers were ezected: President, Charles F. Butcher; Vice-President, Irvin W. Peffly; Secretary and Treasurer, Ormsby F. Potter; Directors, Stanley Grady, A. H. Osborn, R. H. Garrison, S. J. Franklin, and Charles W. Hoy. William H. Pettes was retained as an ex-officio member of the Board of Directors.

CONSOLIDATED GAS COMPANY'S SECURITIES AUTHORIZED.—The applications of the Astoria Light, Heat and Power Company for permission to issue additional stock and bonds, and of the New York Edison Company to issue addition stock were granted recently by the Public Service Commission, by the deciding vote of Commissioner Eustis. The Commission had previously divided equally on the applications. Chairman McCall and Commissioner Williams favoring them and Commissioners Cram and Maltbie voting no. The Astoria Light, Heat and Power Company, of which the Consolidated Gas Company owns all the stock, gets authority to issue $5,000,000 in 5½ per cent. bonds and $9,500,000 in stock, all to the Consolidated Gas Company, to take up notes given to the gas company for money advanced. Commissioner Maltbie had argued that there was not sufficient proof that all the money borrowed by the Astoria had been spent on accounts properly chargeable to capital and because it was ridiculous that the Astoria Company should pay 5½ per cent. on its bonds. He tried to get from President George B. Cortelyou a promise that the company would retain the bonds and would put them on the market, but Mr. Courtelyou refused on the ground that it was beyond the jurisdiction of the Commission. Commissioner Williams said that Inspectors for the Commission had checked up 70 per cent. of the expenditure, to which Commissioner Maltbie referred, and found that it was for capital purposes.

NINTH MEETING, THE NATURAL GAS ASSOCIATION OF AMERICA.—The ninth annual meeting of the Natural Gas Association of America will be held in St. Louis, Mo., May 19, 20, 21 and 22, 1914.

The President, Mr. Ernest L. Brundrett, will call the meeting to order Tuesday, May 19th, at 10 A.M., in the assembly hall, the Coliseum, Washington and Jefferson avenues. The hotel headquarters will be the Hotel Jefferson, Twelfth and Locust streets. In order that the sessions may not be rushed and that the members may have an opportunity to devote more time to the exhibits, it has been decided to hold a 4 day meeting.

The following papers will be presented:

"Gas Sands," by Mr. I. N. Knapp.

"Prevention of Unnecessary Waste in the Natural Gas and Oil Fields," by Mr. J. A. Holmes, Director, United States Bureau of Mines.

"Valuation of Natural Gas Plants for Rate Making Purposes," by Mr. Samuel S. Wyer.

"Losses of Gas in Transportation," by Mr. Alfred J. Diescher.

"Our Illogical Method of Charging for Gas at the Present Time," by Mr. Albert Hurlburt.

"Record of Construction and Repair Mater ial" (illustrated with lantern slides), by Mr. E. Robinson, Jr.

"Accident Prevention" (with lantern slides), by Mr. J. B. Douglas, Manager, Claim Department, United Gas Improvement Company.

"Public Utilities Commissions," by Hon. John W. Atkinson, Chairman, Missouri Public Utilities Commission.

"The Measurement of Gases in Large Quantities," by Mr. J. G. Wilson.

COMMISSIONER MALTBIE ON MAIN EXTENSIONS.—Because of the undeveloped state of street lay-out, with the likelihood that the company would be obliged to relay and rearrange its mains and pay the cost of such work out of earnings, the Commission has refused, at this time, to issue an order to compel the Woodhaven Gas Light Company to make extensions necessary to serve residents of Aqueduct, Howard Estates and Ramblersville, in the Borough of Queens. The company strongly opposed making extensions unless a large part of the expenses of installation and service was borne by the residents or guarantees given as to the amount of gas consumed.

The Commissioner says: "The argument that the service would not pay from the beginning, and that the company ought not to be required to build lines unless the income therefrom will pay from the beginning all expenses and a reasonable return upon that investment is absurb. The statutory obligation to extend to premises within 100 feet of an existing main recognizes no such standard, and all progressive and enterprising companies are constantly building extensions which do not pay immediately. They expect to build up a business, and usually additional consumers are obtained from time to time who are induced to build or pipe their houses because mains are laid. If the only objection were the uncertainty of immediate profit, the problem would be simplified; but there are also certain risks which the company would be obliged to take in laying mains upon streets, or so-called streets, where there is no certainty that the entire layout of the street system will not be changed."

The Commission holds that in the matter of extension of mains, the obligation upon the company is to furnish reasonable service, all things considered. There must be prospect of a remunerative service within a reasonable time, and the likelihood that the company would be obliged to relay and rearrange mains, and pay the cost out of earnings, compels the Commission to decide that the section under review, has not reached the stage of development which would warrant the adoption of an order directing the company to make the desired extensions.

STEEL CORPORATION BENZOL RECOVERY PLANT.—The United States Steel Corporation has decided to make extensive improvements and additions to the by-product coke oven plant at Farrell, Pa., operated by the Carnegie Steel Company. By-product recovery will be carried further than is now done at any of the Steel Corporation's coking operations, the new construstion to include a benzol recovery plant of the Carl Still type. The expenditure involved in the improvements will be close to $500,000, and should give a noticeable addition to the commercial benzol supply.

(*Continued from page* 295.)

honestly say I have heard 25 people ask, "Is it possible to secure this kind of gas lighting? Why, I thought it was electric."

How many more thousand of cases are there, similar to these, where you could hold consumers by educating them in the modern form of gas lighting.

I cannot impress upon you New Business men to strongly the fact that you must adopt other methods of getting business and holding what you already have. Your friendly competitor comes along like a thief in the night with the smooth argument that only in electric lighting can the artistic effects be had. You must practice eternal vigilance and give the old consumers with their antiquated equipment the same care and solicitation you give the new ones. The old consumers are not conversant with the improvement in gas lighting effects and it is up to you to educate them. The appliances can be had if one will make his demands known. Patronize and encourage those manufacturers who are helping you to give service, and who help support your Associations. They are the ones to be trusted as knowing your needs.

To my mind too much time has been spent on fuel appliance to the neglect of lighting. Any thinking person to-day knows that gas is the only sensible thing to use for fuel purposes, cooking, etc. Why not devote some of this energy to restoring the gas illuminating you have lost?

Now, what means can be employed to stimulate the demand for the wider use of gas for lighting? First of all, to my mind, every employee of a gas company should have knowledge of all the commodities you are selling. It was a source of great satisfaction for me in a recent interview with Mr. John Doyle of New York City to learn that he is having prepared in booklet form a concise description of every standard gas burner made, giving its consumption of gas, candle power and cost in use, and defining each burner's adaptibility. In conjunction with this, cuts of modern fixtures, domes and semi-indirect fixtures are shown and their adaptability is defined. I am informed that a copy of this booklet is to be placed in the hands of every employee of the Consolidated Gas Company, making every one of them conversant with all the appliances by which the company aims to interest consumers in the use of gas as an illuminant. This booklet treats only of gas illumination, evidencing the fact that this subject is being seriously considered. The advantage of thus making every employee conversant with gas lighting burners and fixtures is going to be productive of much good. With their thousand of employees mingling with thousands more of friends and associates, they having knowledge of the use of gas for lighting, its advantages and adaptabilities, is sure to result in good to the company. This is educating your family, the home so to speak.

I must cite another case of progressive methods to encourage the use of gas for lighting, here in our own State. Mr. J. P. Hanlan has now in course of preparation, a booklet, to be distributed broadcast in public service territory, wherein gas lighting is more strongly dwelt upon than ever before. Gas lighting appliances will be interestingly shown, and fixtures of modern design intellegently suggested for definite commercial and domestic conditions. This is the sort of education that is needed, and these gentlemen are to be commended for their painstaking efforts.

It is a regretable fact that many gas companies need a little stimulus in this field of their business, and while we stand shoulder to shoulder for the good of the industry, a man in the manufacturing business feels a little delicacy in standing before you gas men in an attitude of criticism. Our hands are tied without your co-operation, yours are tied without ours. Let us unite for the common good.

In conclusion I offer the following suggestions:

1. Make your show rooms a model of gas illumination, by showing the very latest form of lighting; thus showing your consumers the possibilities of up-to-date installations,

2. Educate your employees in their use and adaptability.

3. Sell only those fixtures that are modern and up-to date, recommending suitable burners for the conditions you have to meet.

4. Canvas old consumers and renovate their lighting equipment, selling them combination fixtures if they demand electric; but sell the class of combination fixtures that will give gas a fair show.

5. Watch your Gas Journal for the latest products in lighting fixtures, and encourage those who advertise in them and use their resources to further your interests.

6. Have a special corps of lighting solicitors, to keep everlastingly at it, rather than letting your full force have such a varied assortment of appliances to sell.

7. Keep up your campaigns of education, ever remembering that for artificial lighting nothing equals gas.

8. In newspaper and all other advertising give a little mention to gas for lighting; instead of confining all your printers ink to telling its use for cooking, water heating, etc.

Yield of Gas from Coal as Related to British Therma Units.

[Prepared for Sixth Meeting, Indiana Gas Association, by Mr. J. C. Silverthorn.]

If one considers that the gas industry is entrusted with the responsibility of delivery to the people of a great portion of its reserve energy, he immediately appreciates that the industry has a duty that should be cared for with the best intelligence that education, experience and advancement afford. It is conceded that there is no more economical and efficient way of using some coals, than through the medium of gas, and it is the duty of the industry to attain the maximum possible conversion factor, and conserve the gas coal supply that the earth affords. Upon investigating the history of gas yields from coal, we only need go back a comparatively few years to learn that the yields were not the essential merits in manufacture, the records showing yields varying from 4 cubic feet to 4.5 per pound of coal. As the better knowledge of the limited resources of practical gas making coals was brought to light through the Federal reports, and as the price of this coal is increasing at the rate of approximately 10 per cent for each decade, the industry came to the realization that to continue its unique reputation as being one of the very few agents of the people who has been able to serve them at a continually lowering unit cost, there must be immediate steps taken to conserve the energy entrusted it and to improve the economic factor in conversion of that energy from coal to gas.

In current gas journals you will see advertisements of varied coal carbonizing apparatus, the especial virtue of each type being the greatest yield from coal, and that yield limited only by the heat unit value. When it is realized that the yield per ton of coal is by far the largest item in the economic conversion factor of gas manufacture, and that the total heat units available for gas, is determined by the number of cubic feet extracted from a pound of coal, is it not of paramount importance that the most careful and thorough examination of the limiting factor be made before restricting the amount of gas to be taken from our available resources?

Indiana coal gas operators, with very few exceptions, have outputs that do not warrant the expensive apparatus designed for larger works, and which affords opportunity for greater economic devices. The apparatus that is in general use is the well-known horizontal ½ or ¾ depth recuperative benches, and results from apparatus of this kind are not comparable with those of later and larger designs. It is my purpose, therefore, in this article, to adhere to the conditions of the average plants in Indiana, and not compare our results with types whose primary design is for coke manufacture and in large plants. It is our duty, who have the ordinarily used benches, to gain as much information as possible, and to obtain as much from a pound of coal as our methods and prevailing standards will warrant. Inquiring as to the operating results of 18 companies in Indiana, show an average yield of 4.8 cubic feet, the minimum 4, and the maximum (reached by 6 companies) 5 cubic feet. The approximate tons of coal carbonized for all companies reporting was 346,325, nearly all Pennsylvania coal. With ½ or ¾ depth horizontal benches in general use, records and general practice warrant us stating that a 5 foot yield per pound can be maintained, and is the normal yield for Pennsylvania coal when carbonized in such apparatus. "Normal gas yield," as applied to the practical carbonization of coal for commercial purposes, means the extraction of all the hydrocarbons in the coal, leaving a coke of practically free carbon and very little volatile matter. Analysis of coke from coal carbonized with a gas yield of 5 cubic feet, shows an average of 2 per cent. of volatile matter, and cokes from coal carbonized at lower yields show much higher percentage of volatile matter. From Bulletin No. 1, of the Bureau of Mines, on "The Volatile Matter of Coal," one would derive that the normal yield is greater than 5 cubic feet per pound of Pennsylvania coal. If we are at liberty to grant that such coal has a normal yield of 5 cubic feet, then any yield less than 5 shows incomplete carbonization, and virtually a loss of energy. It will be conceded that high percentages of volatile matter in coke causes a weak cellular structure, and that in

the use of coke of such structure a much larger percentage of the total heat units is wasted. Granting again that 5 cubic feet is the normal yield of Pennsylvania coal, it would seem that the average yield in Indiana operation is 4.8, .2 cubic feet of gas being left in each pound of coal carbonized in the State, or a total of 138,494 M. cubic feet of gas left in the output of coke, and which should be available for use as commercial gas. This condition does not exist in Indiana only. The average yield for a year of 17 companies in Wisconsin, is 4.84, or a loss from the normal of .16 cubic feet per pound of coal, or a total of 55,812 M. cubic feet of gas left in the coke, and practically of no use to any one. From the foregoing, the loss of gas due to incomplete carbonization of coal is apparent. Considering the B. T. U. in gas produced from Pennsylvania coal carbonized in the ½ and ¾ depth horizontal recuperative benches, we meet with rather surprising figures. Below are tabulated 4 cases of operation, the figures taken from long averages. The line 1 represents the average results of operation of a small plant; line 2 the average yield of 17 plants in Wisconsin, having equipment and conditions comparable with that of Indiana; line 3 shows the average results of 3 plants in Indiana; line 4 the average of the tabulation shown on page 43 of the Report of the Joint Committee on Calorimetry of the Public Service Commission and Gas Corporations in the Second Public Service District of New York State:

	Cu. Ft. Yield of Gas Per Pound of Coal.	Cu. Ft. Yield of Gas Per Ton of Coal.	B.T.U. per Cu. Ft. of Gas.	Total B.T.U. Per Pound of Coal.	Total B.T.U. Per Ton of Coal.
1....	4.60	9,200	620	2,852	5,704,000
2....	4.84	9,680	600	2,904	5,808,000
3....	5.00	10,000	590	2,950	5,900,000
4....	5.22	10,400	585	3,053	6,106,000

It will be seen from the above that though the heat units per cubic foot decrease, the total heat units *per pound* or *ton* of coal increase; that the heat unit per cubic foot decrease is 5.6 per cent., while *the increase* in units of heat per pound or ton is 6.5 per cent. In other words, to maintain a 600 B.T.U. gas we must sacrifice from the normal yield of 5 cubic feet, 320 cubic feet per ton, or a total of 188,800 B.T.U.'s per ton of coal carbonized. This represents incomplete carbonization to the extent of 64 pounds of coal for every ton charged.

It must be borne in mind that the above data and calculations are based upon the results from horizontal ½ and ¾ depth recuperative benches designed for a normal yield of approximately 5 cubic feet per pound of coal. If the precedent and prevailing heat standard is set from determination made in localities where the yield is lower than the normal and therefore higher in unit heat value, it is our duty to use the greatest diligence and ingenuity to approach the normal and highest yield in order to lessen the loss of energy and maintain the highest quality of gas coke. With apparatus in general use in Indiana, every point in the process of the carbonization of coal, from the perfect retort through an absolutely faultless hydraulic main into clean purifiers, must be watched with more than ordinary care to advance the economic conversion factor. The Indiana operator to-day feels that his plans for the future are possibly destroyed. His plans for more advanced carbonizing processes must be changed. He cannot consider the present day designs of verticals built for greater yields; chamber ovens or gas ovens would not be practical, for these processes depend upon the coke market for their success when the yields up to only 4 8 cubic feet per pound can be distrib uted.

When any other coal except the best gas producing coal is used, very much lower yields will result in order to maintain 600 heat unit quality. The Indiana operator feels, therefore, that his only practical plan is to continue his present process, adding new devices as they develop, and doing the best that he can in the conversion of that energy, with due compensation to himself and the lowest possible cost to his consumers.

An exceedingly interesting article in the AMERICAN GAS LIGHT JOURNAL, of March 2d, on "Notes on Verticals in England," tells us of the wonderful results that are being made in that country, yields ranging from 11,000 to 12,800 cubic feet per ton, with heating values from 500 to 575 B. T. U.

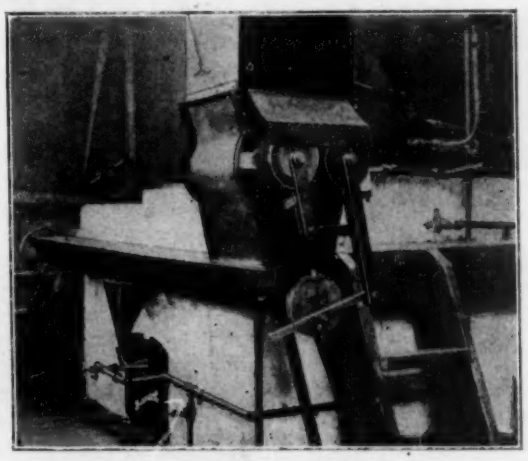
In concluding this short review of the yields of gas as related to B. T. U., we wish to say that there is much more information that should be investigated and brought to light to help deliver to the people the heat stores of the earth in the most economical manner.

Burning Pulverized Coal and Oil Mixed.

[From a paper by MR. ALEXANDER TRAUDT.][1]

Noting the recent articles in technical journals, regarding the burning of pulverized coal, prompts me to put in writing the results of several tests I made in 1906-1907. Although tests were run using plain pulverized Clearfield coal, anthracite and coke, also combinations of the above with crude molasses and combinations with fuel oil, I will give here only the results obtained from the Clearfield coal and oil mixture, which proved best after numerous trials and combinations. Bear in mind that these combinations were absolutely dustless, and could be handled like a very fine moist sand.

The boiler used was a Roberts safety water tube. It was placed on a firebrick base about 3 feet high. Inside of the base, a narrow combustion chamber was built, about 2 feet wide and 2 feet high, and extending half the length of the boiler. From mud drum to mud drum, and extending the entire length of the boiler, there was a firebrick arch, having 2 x 2-inch openings, equally spaced. Closing the front of the furnace was a double sheet iron door, with a 2 inch hole in the center, through which the burner was placed.



Apparatus as Applied to Boiler.

The fuel was supplied to the burner by means of 12 x 12 inch hopper, in which two 6-inch rolls, 12 inches long, were placed in a horizontal position. Each roll had 12 vanes, ½ inch high and 12 inches long, equally spaced around the circumference. By means of dogs and ratchet wheels, these rolls were made to revolve and deliver a constant quantity of fuel to a 4-inch screw conveyor, in a horizontal position, as indicated in the accompanying reproduction of a photograph, and extending over the entire width of the furnace.

Directly over the center line of the burner, ¾-inch holes were drilled in the bottom and sides of the trough, to allow the fuel, as it was being pushed forward by the screw, to drop into a small hopper attached to the burner. From the hopper the fuel was blown into the furnace by means of a steam jet, which passed through a hole about ¼ inch in diameter. Of course, considerable experimenting was necessary before the right shape and size of burner was obtained to divide the fuel finely on entering the combustion chamber. The average pressure of the steam used was about 93 pounds.

It is obvious that by this screw conveyor method a whole battery of boilers could be fed, each one getting the exact amount of fuel required. In case any one of the boilers were cut out, a small slide underneath the holes in the conveyor trough was closed and the surplus fuel passed on to the end of the conveyor, where in large plants it could be conveyed back to the storage bin. The fire was started in the furnace by means of wood fanned into a white hot flame by means of the steam jet from the burner, which on starting was fed from an auxiliary boiler. It took about 15 minutes before the furnace was hot enough to blow in the fuel.

In the accompanying report of three tests no alterations were made in the furnace, feeding apparatus, burner or fuel. The better economic results were obtained by a more nearly correct supply of fuel and better manipulation.

Tests of Steam Boiler with Pulverized Fuel.

(A) Alternate method of starting and stopping tests was used.
(B) Boiler—Roberts safety water tube.
(C) Water heating surface = 400 square feet.

1. *Iron Age.*

(D) Superheating surface = 50 square feet.
(E) 1 cubic foot of fuel = 27.32 pounds.

Total Quantities.

Item.	Test Number 1	2	3
1. Duration of trial, hr	4	5.58	5.58
2. Weight of mixture as fired, lb	404	626.94	737.5
3. Residue in lb	.....	.....	47.5
4. Percentage of residue in fuel	.....	.....	6.4
5. Weight of water to boiler in lb	2,962.75	4,655.72	5,925.5
6. Factor of evaporation	1.0379	1.0864	1.0873
7. Water actually evaporated corrected for superheat, lb	3,156.81	4,994.22	6,856.2
8. Equivalent water evaporated into dry steam from and at 212°, lb	3,434.29	5,425.72	6.911
Hourly Quantities.			
9. Fuel consumed per hour, lb	101	112.25	132.16
10. Water evaporated per hour corrected for superheat, lb	789.2	895.02	1,139.1
11. Equivalent evaporation per hour from and at 212°, lb	858.57	972,85	1,238.53
12. Equivalent evaporation per hour from and at 212° per square foot of heating surface, lb	1.9	2.43	2.75
Average Pressures and Temperatures.			
13. Steam pressure by gauge, lb	93.1	91.2	93.2
14. Temperature of feed water entering boiler, degs. F	164.4	165.5	165
15. Temperature of escaping gases from boiler, deg. F	432	448	461
16. Superheat in steam, deg	113	.....	131.7
17. Temperature inside room, deg	70.1	73.5	77.9
18. Temperature outside, deg	39.6	28.6	34.9
Economic Results.			
19. Horse power developed	24.88	28.18	35.9
20. Builders' rating, horse power	....	....	....
21. Percentage of builders' rating	....	....	....
22. Water apparently evaporated under actual conditions per pound of fuel, as fired, pound	7.81	7.42	8.64
23. Equivalent evaporation from and at 212°, per pound of fuel, as fired, pound	8.5	8.64	9.37
24. Fuel used per horse power hour, pound	4.6	4.00	3.68
25. Equivalent evaporation per pound of combustible, pound	....	....	10

For the last 3¼-hour of test No. 3 my data sheets show a conumption of 423¼ pounds of water every 20 minutes. As the fuel supply was constant, this shows that when the furnace reached its maximum temperature, the evaporative power of the boiler became constant and maximum for the weight of fuel consumed per hour. The temperature of the flue gases during the last 3¼ hours was constant at 480°, whereas the average temperature of the whole test was 432° F.

If we consider the last 3¼ hours of test No. 3 only, the economic results would be as follows:

(1)	Water apparently evaporated under actual conditions, per pound of fuel as fired	9.51 pound.
(2)	Equivalent evaporation from and at 212° per pound of fuel as fired	10.34 "
(3)	Equivalent evaporation from and at 212° per pound of combustible	11 "
(4)	Fuel used per hour, per horse power	3.33 "
(5)	Combustible consumed per hour, per horse power	3.12 "

These last results are comparable to some of the most efficient tests ever run on large economical water tube boilers of the best make and setting. Combustion took place without smoke, and the ash was a grayish white powder, practically free from carbon.

At the annual meeting of the Lawrence Township (N. J) Gas Light Company, these officers were elected: President, F. G. Mayhew; Vice-President, Walter Owen; Secretary, C. M. Nixon; Treasurer and General Manager, S. J. Franklin.

Color of Lights.

The "Journal für Gasbeleuchtung," quotes Herr L. Bloch, before the German Illumination Association, on methods of measuring the color of the light from different sources. From a purely scientific view, the problem has been satisfactorily solved, the spectro-photometer and curves of comparison can be drawn for all parts of the spectrum. For technical determinations, Voege, in 1905, used screens of colored glass, dark-red, red, yellow-green, green and blue, and obtained comparative data, using diffused daylight, with a cloudy sky, as a standard. This was a great improvement, as regards simplicity, upon the spectro-photometric methods, but still was not simple enough. Experiments by the author, restricted to the red, green and blue, have worked well.

The glass used for red was Schott's F4512; for green, F6380, and for blue, F3873, the curves of transpareucy for which are known. The glass screens are in the form of discs, 0.28-inch in diameter, and 0.04-inch thick, mounted in a rotating diaphragm, with a spare aperture for the direct transmission of light unscreened.

The measurements were made on ordinary photometric principles, a Brodhun street photometer being used to give a wider range than the ordinary bench photometer. As far as possible, however, the same range of values should be adhered to, for screens for milk glass and smoked glass bring in differences of transparency to the different colors of light. For example, a smoked glass passed 27.4 per cent. of white light, 30 of red, 27.2 of green, and 28.1 of blue; a milk glass passed 21.3 per cent of white light, 23.5 of red, 21.1 of green, and 19.9 of blue. These differences can be ascertained and allowed for, but it is better to avoid this trouble.

The standard of comparison is daylight, under a cloudy sky, about midway between direct sunlight and light from a blue sky. As an intermediate standard, the lamp of the photometer, a small metal filament lamp, of 0.8 ampere, consuming 1.2 watts per Hefner, was used. Measurements were taken in the three colors, and in direct unscreened lights, the last, only when it was necessary to find the actual value of the white light given out. For instance, we might wish to find how the color of the light from a filament lamp varied as the lamp was driven at different intensities. If the lamp under investigation was not constant in intensity and color, the measurements were repeated and averages taken. The ratio red to green and blue to green were found from the data obtained, and expressed in percentages, figuring the green as 100. The figures so obtained refer to the photometer standard lamp, not to standard daylight, but can be reduced to terms of the latter from the known factors for the photometer lamp. Thus, an intensive arc lamp for yellow light gave red-green=46.2 per cent.; blue-green, 57 per cent., in comparison with the photometer standard lamp; which, on being reduced to comparison with the daylight standard, gave the red-green=99.5 per cent. of the red-green in daylight illumination, and the blue-green =29.5 per cent. If we specified this light as $\frac{99.5}{29.5}$ we would have a clear idea as to the kind of light sent out by the particular lamp. We could also plot out the relation of the two values on a chart, making "blue-green" ratios as abscissæ and "red-green" ratios as ordinates. The character of the light is then specified by the position of a single point on the chart. Standard daylight would be represented by a point $x=100$, $y=100$.

Among the results obtained it may be noted that direct sunlight shows a slight excess in the red and deficiency in the blue; in the light of a blue sky there is a considerable excess of blue. Solid, liquid and gaseous combustibles give much red and are defective in the blue, and there are differences among them greater than might have been expected from naked eye observations. Acetylene gives less red than a gas flame in a slit burner, but more than an incandescent mantle, and it very closely resembles the light from a metallic filament electric lamp. The light of burning magnesium comes nearer to daylight than any solid or gaseous combustible. Incandescent mantles differ very little from one another in the kind of light they give if the pressure is low; but at high pressures there is more red with mantles of artificial silk than from mantles of ramie. When plotted as points the different incandescent electric lamps group themselves into a curve which surrounds the points for solid, liquid, and gaseous combustibles. This curve is characteristic of pure-temperature radiators. The mercury vapor lamp, with ordinary glass, shows almost complete absence of red, and also is unexpected poverty in blue rays; and the Moore vacuum lamp, with carbonic acid in

the bulb, gives a light extremely close to daylight under a cloudy sky.

Kind of Light.	Ratio Red-Green (Green = 1.0)	Ratio Blue-Green (Green = 1.0)
Daylight, cloudy sky	100	100
" from blue sky	80.5	116
Sunlight (slightly hazy)	116	92
Stearin candles	463	34
Oil lamp	403	36.5
Bunsen burner with luminous flame	367	37.5
Illuminating gas, slit burner	313	46
Acetylene two-jet burner	263	48.5
Low pressure incandescent gas mantle, vertical	190	50.5
" " " " " inverted	185	51.5
" " intensive lamp	189	50.5
Pressure gas with ramie mantle	204	51
" " " mantle of artificial silk	219	50
Magnesium ribbon lamp	138	63.5
Carbon filament lamp ....4.0 watts per Hefner.	342	43
" " " ....3.5 " " "	330	44
" " " ....3.0 " " "	317	45.5
Metallized carbon filament lamp ....2.5 " " "	305	47
Metallized carbon filament lamp ....2.0 " " "	290	49
Nernst lamp, without globe ..1.7 " " "	275	48
" " with opal globe .1.7 " " "	284	49
Tantalum lamp ....1.7 " " "	300	47
Metal filament lamp ....1.2 " " "	271	50.5
" " " ....1.0 " " "	256	53
" " " ....0.8 " " "	245	55.5
Intensive metal filament lamp .0.6 " " "	211	59
" " " " 0.5 " " "	200	61.5
" " " " 0.4 " " "	190	63.5
" " " " 0.5 " " "	212	59
Carbon arc, without globe	160	71.5
" opal globe	180	62
Economizer arc lamp, without globe	185	70.5
Printing arc lamp for 150 volts	161	86.5
Daylight arc lamp, without colored glass	158	69.5
" " " with " "	68	100.5
Magnetic arc lamp	114.5	85.5
Intensive flame arc lamp for white light	125.5	63.5
" " " " " yellow light	99.5	29.5
" " " " " red light	592	74
TB flame arc lamp for white light	114.5	56.5
" " " yellow light	99	29
" " " red light	545	63
Mercury vacuum lamp, glass	9	32.5
Mercury vacuum lamp, glass, with rhodamine reflectors	27.5	34
Mercury vacuum lamp, quartz, without globe	20	30
" " " " with globe	20	25
Moore vacuum lamp, with carbonic acid.	85	108
" " " " nitrogen	655	15
" " " " neon	2,240	6

New Methods and Appliances.

INVERTED LAMP WITH MANTLE OF LESSENED SURFACE.—In the *Journal für Gasbeleuchtung* Mr. C. Killing described an inverted burner in which the mantle is reduced in size and raised up into the flame, instead of being located in the outer zone of combustion.

In examining an upright bunsen flame, Schmidt found the outer zone had a temperature of 1,800° C., with 1,600° in the middle of the middle zone; but he did not notice that at 1 m. m. above the gauze there was a temperature of 1,800° in the axis of the flame.

While inverted flames are very much more difficult to explore, being less steady, the wire method is comparatively easy to apply. With a chromine gauze the inner green cone is found to descend as the lamp becomes hot, but its position can be regulated by regulating the access of air. Here again the hot spot of the flame is at the tip of the inner green cone; but it is not as hot as in the case of the erect flame. Without a gauze there is only one green cone, and the temperature at the hot spot is not as high as with a gauze. In the green cone the temperature is higher the greater the proportion of air in the mixture, but the primary air is completely used up in the cone. Haber and Richardt found lower temperatures than those found by the author at this hot spot, but they worked without a gauze and with mixtures containing less air, and they had, therefore, a more inflated green cone of larger surface.

This hint as to the hottest spot of the flame led to the new design burners, with large primary air supply and the green cone restricted. The mantle made to fit this cone and the light produced is correspondingly high, according to the known fifth-power law. The mantles are very short, and therefore stronger. Under the gauze (which may be, say, perforated steatite) there is a multiple of small green cones, which, together, give a flat region of maximum temperature, with a tendency to descend in the center. The mantle is hung a little below the surface of the green cones, so as just not to be cut by the further-descending part of the aggregate. When the lamp warms up the mantle becomes extremely hot and bright. Of the full effect, 55 per cent. is reached in 15 seconds, 93 in 10 minutes, and the whole in 25 minutes.

The light downward is extraordinarily high, and the horizontal intensity is adequate for a good general illumination, giving the distribution of light which the electricians are striving to attain. The low consumption of gas per unit of light has hitherto only been reached in high pressure lamps.

MONEY NEEDLESSLY SPENT FOR OIL.—N. G. Near, in *Iron Age*, says every engineer has doubtless studied the characteristics of oil to some extent and knows a little about flash point, viscosity, gravity and other properties of minor importance, the three mentioned usually being considered the most important. How many ever make use of this knowledge? Yet in connection with oil important savings are possible. The equipment needed for making the three most important tests is usually found in any manufacturing plant; a thermometer for the flashing test, a pair of scales for the gravity test, and a tin can with a hole in its bottom for the viscosity test. This apparatus may be regarded as crude, but it will give surprisingly accurate results—results that will at least be comparable.

An acquaintance recently went into a large plant where considerable oil is used, and was surprised at the high price being paid for oil, which looked just like the oil he had been using, that sold at one-fourth the cost. So he decided to give the two oils a thorough try-out side by side, both by physical tests and actual usage in a machine that could be cut out at any time without interfering with the operation of the plant.

He found very little difference in their physical characteristics, as he expected, and when applied to the machine he found the lower priced oil gave the better results. His method with the machine was to run it at normal speed with one of the lubricants and quickly throw a switch, and by his watch took the time required for the machine to come to a standstill at no load. Then he tried the other lubricant under full and no load, just as with the first, and after a time took the stopping time with the second oil. Then he retried the first. Then he retried the second, and so on. Finally he decided that the less expensive oil was the better, and he convinced the manager that he was right.

Thousands of dollars are lost in this way simply because the men who buy the oil believe they get the best that can be got by paying the highest price. Make a comparative test on a machine and see if costs cannot be cut.

FIRE-PROOFING WOOD.—In an investigation carried on at the Forest Products Laboratory at Madison, Wis., it has been found that the chemicals most efficient in rendering wood non-inflammable are those that sublime or decompose when subjected to heat. Non-combustible gases are then given off which mix with the inflammable gases from heated wood, rendering them non-inflammable.

The chemicals selected for experiments were divided into two classes.

(1) Chemicals that "sublime" when subjected to heat, whose vapors are not inflammable, such as ammonium sulphate and ammonium chloride; and (2) chemicals that decompose when subjected to heat, giving off non-inflammable gases, such as ammonium phosphate, sodium bicarbonate and oxalic acid. A method used in previous fire-proofing work has been to inject chemicals such as borax or alum containing large amounts of water of crystallization, the theory being that the water is converted into steam, which creates a

non-inflammable atmosphere outside the wood. Borax has the advantage of being a fusible salt, thereby protecting the wood fiber with a glossy coating. The results obtained to date in the experiments are:

1. Ammonium salts are of considerable value in fireproofing wood, it being impossible to ignite wood, under the test conditions, that had been treated with these salts.

2. Borax is of considerable value, although not of the value of the ammonium salts. It, however, promises a means of lessening the cost of treating by using it with another salt of greater value.

3. It appears possible to devise a reasonably inexpensive method of rendering wood fire-retarding.

4. Of eight untreated species of wood tested, tamarack is the most fire-resistant. Redwood comes next, even though Western larch and noble fir were slower to ignite.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,090,671. Appliance for Gas Lights. J. A. Abrams, Wadsworth, O.

1,090,714. Gas Lighter. J. Holtzman and L. Gefon, New York city.

1,090,737. Method of Indicating the flow and Leakage of Gas. D. McDonald, Louisville, Ky.

1,090,769. Automatic Safety Gas Valve. J. Wescott, Hornell, and C. B. Smith, Prattsburg, N. Y.

1,090,780. Rotary Gas Meter. E. B. de la Matyr, Los Angeles, Cal.

1,090,785. Artificial Lighting Means. H. E. Ives, Mount Airy, Pa., assignor to The United Gas Improvement Co., Philadelphia, Pa.

1,090,813. Apparatus for the Manufacture of Coal Gas. R. C. Congdon, Atlanta, Ga.

1,090,857. Hopper for Gas Producers. W. A. Jones, West New Brighton, N. Y., assignor to The Babcock & Wilcox Co., Bayonne, N. J.

1,090,864. Gas Meter. W. H. Knight, Cleveland, O.

1,091,002. Inverted Gas Light. J. H. Maertin, Chicago, Ills.

1,091,108. Valve for Gas Burners. E. S. Allen, New York city.

1,091,111. Apparatus for Generating Gas. D. D. Barnum, Worcester, Mass., and H. A. Carpenter, Sewickley, Pa., assignors to Riter-Conley Mfg. Co., Pittsburgh. Pa.

1,091,253. Gas Burner. L. Strockstrom and H. H. Parpert, St. Louis, Mo., assignors to American Stove Co., same place.

1,091,357. Oil Pumping Apparatus for Gas Machines. Mathias Laux, St. Louis, Mo., assignor Aero-Gas Machine Co., same place.

1,091,649. Gas Stove. C. F. and F. L. Grady, Buffalo, N. Y., assignors by mesne assignments to Jewett & Co., same place.

1,091,663. Gas Burner. G. B. Killam, Calgary, Alberta, Canada.

1,091,755. Gas Burner. W. W. Ogden, Paquoketa, Ia.

1,091,943. Gas Broiler. Henry C. Maul, Detroit, Mich., assignor to The Michigan Stove Co., same place.

1,091,991. Safety Gas Cut-Off. R. A. Waxler, Lawrenceville, Ills.

1,092,048. Gas Meter. C. E. Hibbard, London, England, assignor of three-tenths to F. L. Goad, Edinburgh, Scotland.

1,092,686. Controlling Device for Gas Burners. H. C. Yingling, Baltimore, Md.

1,092,950. Method of Manufacturing Coal Gas and Coke. W. P. Parsons, Flushing, N. Y.

1,093,026. Combination Gas Valve. J. W. Ashbraugh, Bremen, O.

1,093,180. Safety Device for Bunsen Burners, Gas Cooking Ranges, and the Like. I. de Haan, Amsterdam, Netherlands.

1,093,470. Process of Manufacturing Illuminating and Fuel Gases from Wood. R. M. Poole, Mount Gambier, South Australia.

1,093,499. Gas Heating Stove. J. M. Tobias, Pittsburgh, Pa.

1,093,772. Gas Burner. J. Ellis, Pittsburgh, Pa., assignor to Beler Water Heater Co., same place.

1,093,872. Controller for Gas Stoves. S. F. Mioton, New Orleans, La., assignor of two-fifths to J. Oury, same place.

1,093,936. Apparatus for Discharging Vertical Retorts. H. Koppers, Essen-on-the-Ruhr, Germany, assignor to H. Koppers Co., Chicago, Ills.

1,094,214. Gas Lamp. G. Keith, London, England, assignor of one-half to J. Keith, same place.

1,094,280. Gas Generator. D. R. Way, Fairfield, Ia.

1,094,287. Gas Heater. G. A. Wise, Newark, O., assignor to The Early Sun Stove Co, same place.

Items of Interest
FROM VARIOUS LOCALITIES.

THE Amherst (Mass.) Gas Company has sold all its gas and electric appliances and the appliance business to Messrs. C. H. Rumery and W. B. Fay, who will hereafter do all the company's house piping and wiring. This change was made because the work of the office had grown so rapidly that a division of labor seemed necessary. There is also an opportunity for a saving of several thousand dollars per annum by separating the company's principal business of manufacturing and selling gas electricity from the work of installing and caring for gas and electric systems in buildings. The general public will be little affected by the change, Mr. Rumery and Mr. Fay being well known and liked in Amherst and there is the general desire that they may be successful in their new enterprise.

"R. P.," writing from St. Paul (Minn.), advises us that consideration of the city ordinance putting in force the 85 cent gas rate has been postponed until the meeting of the Assembly on May 13th. Mayor Keller protested emphatically against further delay, declaring that the request for more time by the St. Paul Gas Light Company was not that it might get disinterested experts to pass on the report of Dr. E. W. Bemis, but merely to delay action in the hope that "it can find some way in which it can pull itself out of the hole in which it finds itself." The motion to defer consideration was carried by a vote of 6 to 3.

THE Peoples Gas Light and Coke Company have acquired a plot of 208,000 square feet, fronting on the North branch of the Chicago River, on both sides of Elston Avenue, just north of Wade Street, for a consideration believed to have been around $250,000, or about $1.20 a square foot. The premises adjoin the Division Street gas works, and will be used for additional storage tanks or extensions to the gas plant.

MR. W. L. KEPLINGER, receiver for the Newton (N. J.) Gas and Electric Company, is engaged in a thoroughly overhauling of the company's plant, in conformity with the orders of the State Public Utilities Commission. The work is to be done with dispatch, and in the best manner possible.

AN injunction has been filed by citizens of Coscob (Conn.), restraining Mr. H. R. Brayton, President of the Citizens Gas Company, from building a gas plant on the property formerly known as the Palmer & Duff coal yards. "The plaintiffs are the owners of land and dwelling-houses situated at various points from 100 to 1,000 feet from the property, and object that obnoxious odors, dirt, ashes, cinders, vapors and smoke arising from such a plant would prove a great public and private nuisance. Its proximity to the Mianus River would destroy all shellfish, causing irreparable loss to the plaintiffs, as well as the bathing beach, which is now used by hundreds of people. The plaintiffs further claim that there exists at the present time a gas main, supplying gas to part of the town of Greenwich, and since the gas main is controlled by the President of the Citizens Gas Company, it could be used in supplying the needs of the community, thereby making unnesessary the construction of a mercantile establishment for the production of gas."

"B. T.," writing from Tonawanda (N. Y.), says: "The H. L. Doherty Gas Corporation of New York are reported to be planning a large gas plant to be built in the the town of Tonawanda to supply the entire Niagara frontier with gas. With a good market for coke near at hand it is thought gas can be profitably sold at about 50 cents per thousand."

BECAUSE it does not desire the reputation of furnishing natural gas exclusively, the Sacramento (Cal.) Natural Gas Company has filed a petition in the Superior Court to change its name to the "Sacramento Gas Company."

AMONG the refugees from the City of Mexico that reached Vera Cruz last week, were Mr. N. D. McPhail, General Manager of the

Mexican National Gas Company, and Mr. James Carson, Contract Agent of the Light and Power Company. They were among those who stayed on the ground until it became reckless bravado, and it was only under assumed names and the protection of the British representatives, that they and their families were enabled to reach the coast city in safety.

BEGINNING May 1, the residents of Spokane would have had $1.30 gas, had the city council a year ago not turned down the rate agreement which had been entered into with the Spokane Falls Gas Light Company by Commissioner C. M. Fassett. According to that agreement the people were to receive $1.40 gas up to May 1; $1.30 gas from May 1, 1914, to May 1, 1916; $1.20 gas from May 1, 1910, to May 1, 1920; $1.10 gas from May 1, 1920, to May 1, 1922, with $1 gas after May 1, 1922. The then council appealed the case to the public service commission with the result that the city got a rate of $1.40, which now obtains.

THE Board of Review has placed the assessment on the Detroit City Gas Company's property at $7,000,000, an increase of $200,000 over the assessment last year. The gas company submitted a statement to Assessor Dilworth, fixing the amount of its assessable property at $5,133,000, but the Board of Review raised the amount to $7,000,000, and officials of the company will be given a chance to protest.

MR. CYRUS S. EATON will join the firm of Otis & Co., investment bankers, of Cleveland, Ohio. Mr. Eaton has been occupied in the management and financing of public utility companies, and is President of the Continental Gas and Electric Corporation, which owns gas and electric lighting companies serving thirty towns in Iowa and Nebraska. He is also Secretary and Treasurer of the Brandon Gas and Power Company of Brandon, Manitoba, and will continue his connections with his operating and financing companies.

THE gross receipts of the Portland (Ore.) Gas and Coke Company, for the year 1913, were $1,222,883.38, according to the statement filed with the City Treasurer. The statement is filed under protest, and the 3 per cent. tax on this amount is not forthcoming, owing to the fact that the Supreme Court has not yet ruled on the validity of the ordinance requiring the Gas Company and the Portland Railway, Light and Power Company to pay to the city annually 3 per cent. of the gross receipts. The ordinance was adopted by the people June 5, 1911, and later fought by the public service corporations affected, with the result that the Circuit Court declared the ordinance void. A few months ago the council authorized City Attorney La Roche to appeal to the Supreme Court, and action is now pending.

THE Minneapolis "Journal" has this to say regarding the rate controversy in St. Paul: "Minneapolis made a good bargain with the Gas Company when it settled the contention over rates out of court. That was plain on the face of it. The progress of the St. Paul contention makes it clearer. St. Paul would have been content to reduce its cost of gas to the 85 cents we were paying, when the council passed the 70 cent ordinance. We have a 77 cent rate by conference, while St. Paul is facing litigation in its contention for 85 cents. There are apparently no local conditions of production and distribution to make gas justly lower in Minneapolis than in St. Paul. Material and wages must be practically equal. The costlier rock blasting for piping in the older part of St. Paul was done and paid for long ago. Territory for extensions is alike in soil, though perhaps more extensive here. If the unit cost of production is higher in St. Paul than in Minneapolis, it must be due to a difference in cost of plant and operation. The whole argument of the St. Paul Company is that the 85 cent rate is confiscatory; that the expert estimate of the valuation of the plant is too low, and the percentage of earning allowed upon it unfair. St. Paul may have to take the 85 cent ordinance into court and endure long litigation before it becomes effective. Minneapolis got a rate 8 cents lower at once by a settlement out of court. That is the best kind of settlement for all parties."

AN investigation of the rates, physical properties and the finances of the Houston (Tex.) Gas Company and of the Southwestern Telegraph end Telephone Company, for the purpose of ascertaining whether their rates are equitable and whether reductions may justly be requested, has been ordered by the municipal government. A formal contract between the city and a firm of investigators has been practically closed, and the work of probing the two companies may be started on May 1. About 3 years ago the gas company was granted a new franchise, and the question as to whether the city could legally order the company to reduce its rates, arose. Answering the the question, the city's legal department declares the franchise specifically states that the city shall have the power to control the rates. The franchise provides that the company shall not charge more than a certain amount for gas, but no restrictions are placed on the minimum rate to be charged.

AT a recent meeting of Civic Centre, No. 70, in Baltimore, Md., Mr. L. B. Wilson, Jr., of the Baltimore Consolidated Gas, Electric Light and Power Company, delivered an illustrated lecture on the "Construction and Operation of the Gas Meter, Gas Range and Gas Water Heater." His exposition was closely followed by a large and appreciative audience of gas consumer, much to their profit.

THE New York and Richmond Gas Company (Staten Island, N.Y.) has moved into its new offices in Bay street, Stapleton. The ground floor is 50 feet front by 75 deep and the indirect lighting system, combined with the enormous show windows, give an imposing appearance to the whole. In the cashier's room there is a large bank vault and to the right of this are the offices of the Comptroller. On the left there is an airy compartment for the stenographers and another for the auditing department. In the rear, with an outlook on the Bay, is the room of President W. J. Welsh. In the basement, which has the same dimensions as the first floor, are situated the bookkeepers' room and the application department, also lighted by the indirect system. Portions of both floors will be set aside for exhibiting and demonstrating the last and best in gas appliances and lighting fixtures.

AFTER having been held up several week at the suggestion of Mayor Preston, of Baltimore, the contract for gas in the city street lamps and public buildings has been given the Consolidated Gas, Electric Light and Power Company by the Board of Awards. It is to run for one year only and at the present rates, which are 67½ cents per 1,000 cubic feet for gas consumed by the street lamps and 75 cents per 1,000 cubic feet for gas used in the city buildings.

THE Welsbach Street Lighting Company and the Springfield (Mass.) Gas Light Company, have submitted a joint bid for furnishing high-pressure service for the street lighting in the central part of that city. The bid was submitted to the Supervisors by representatives of the two companies, who explained their plan to Prof. H. E. Clifford, the lighting expert employed by the Supervisors. Estimates were furnished also for lighting the outlying districts, thus covering the entire contract for street lighting.

THE Ohio Cities Gas Company has been incorporated under the laws of Ohio, with capitalization of $10,000,000 preferred and $10,000,000 common stock, by interests associated with the Columbus Gas and Fuel Company and the Dawes Syndicate of Chicago. The new corporation will take over the Columbus Gas and Fuel Company, the Springfield Gas Company, the Federal Gas and Fuel Company, the Columbus Oil and Fuel Company, and probably other natural gas companies in the Columbus and Dayton districts.

ARRANGEMENTS have been made by the Haverhill (Mass.) Gas Light Company to refund to its customers the money which has been paid for gas in excess of 80 cents per 1,000 cubic feet from February, 1913, to the present time, carrying out the provisions of the settlement of the case which involved the price of gas in Haverhill. The following notice has been sent to consumers: "On April 10, 1914, this Company reduced its rate to 80 cents per 1,000 cubic feet, the reduction to take effect as of February, 1913. Any amounts collected from you after that date and prior to April 1, 1914, in excess of a net rate of 80 cents will be refunded to you by the Clerk of the District Court in Boston, with whom such amounts are now on deposit. As there are over 10,000 accounts to be adjusted several weeks will be required in which to prepare refunds. Checks will be mailed by the Clerk of the District Court to those to whom refunds are due, as soon as the work of preparation can be completed."

THE town meeting at Lawrence, Mass., called for May 11th, will consider this article; "To see if the town will vote to make a contract with the Lawrence Gas Company for street lights."

Utilities Commission News.

CALIFORNIA RAILROAD COMMISSION REVERSED.—A decision of the Supreme Court of California reverses the finding of the Commission in refusing permission to the Oro Electric Corporation to exercise a franchise privilege granted by the municipality of Stockton, on the grounds that public convenience and necessity did not demand competitive systems in that city. The court now rules that the power granted to the Commission by the public utilities act to grant certicates of public convenience and necessity is unconstitutional as applied to municipalities, unless the necessary powers are voluntarily surrendered by the municipalities to the Commission. The decision curtails the power and jurisdiction of the Railroad Commission and reverses what the Commissioners thought to be the law, and gives to municipalities the right to regulate utilities to which they have granted franchises.

OBLIGATION TO EXTEND SERVICE.—The Connecticut Commission in deciding a case on which the contention was raised that the probable returns would not pay a reasonable interest on the expenditure necessary, had this to say:

"In determining the merits of the petition, the Commission is governed by the same consideration as influenced its decision in the case of Stoddard v. United Illuminating Company. In that case we found it was the duty and legal obligation of a public service company to extend its service at the request of prospective patrons within its chartered territory, unless there should appear a decided variance between the cost of such extension and the probable income to the company from the new patrons served. We held in that case that a showing of a possible small net loss on such an extension would not warrant us in refusing to order the same, because a public service company is bound, within reasonable limits, to give service in parts of its territory of below average profit as well as in territory of average or of above average profit. The prospective ratio between the cost and the income is a material factor in such cases, and if it appears that the company would suffer great loss it is inequitable for us to decree such extension."

CONSUMERS MUST GUARANTEE FAIR RETURN.—The New Jersey Commission has decided that if the prospective patrons will guarantee the payment of the difference between net revenues accruing and an 8 per cent. return on plant investment and other approved costs, then an extension of gas mains along Canal street, in the Borough of South Bound Brook, will be ordered. The statute governing limits the Commission's power to cases "where, in the judgment of said board, such extension is reasonable and practicable and will furnish sufficient business to justify the construction and maintenance of the same, and when the financial condition of the said public utility reasonably warrants the original expenditure required in making and operating such extension."

In determining the amount of the investment to be made the Commission says:

"The investment made by the company for the benefit of these petitioning consumers will consist not only of the mains, meters and services on Canal street, but also in a part of the generating plant and trunk mains from which these mains are fed. It was found in the one division of this company most thoroughly examined that for every 1,000 feet of annual sales the investment in generating plant and transmission mains was about $1.50. Hence, if the probable annual sales of gas through these new mains can be estimated, the part of plant investment fairly to be added to the cost of mains, services and meters in this particular vicinity may be approximately arrived at."

DOES NOT FAVOR COMPETING COMPANIES.—The Pennsylvania Commission has just handed down a deision denying the application of the Schuylkill Light, Heat and Power Company for permission to carry on electric lighting business in the Borough of Ashland, now served by the Eastern Pennsylvania Light, Heat and Power Company, the subsidiary lighting company of the Eastern Pennsylvania Railways Company, which is under the management of The J. G. White Management Corporation.

The Commission held "that a reliance upon competition between public service companies for securing adequate service and proper rates has not been successful and that hereafter supervision by properly constituted authorities is to be substituted;" that competitive companies are invariably merged and the citizens are compelled to pay rates sufficient to give a return on the investment of duplicated properties.

This was the first case of its kind before Pennsylvania Commission, and the decision is of great interest to all public utilities in the State.

Financial Notes.

APRIL output of Boston Consolidated Gas Company, shows increase of 3.2 per cent. over last year. March increase was 4.78 per cent.

A SPECIAL meeting of Pacific Gas and Electric stockholders has been called for May 18, for the purpose of receiving proposals for permanent financing. It is expected that the officials of the company will present a plan calling for the issuance of preferred stock. When it approved the $7,000,000 one-year notes of the Company recently, the California Railroad Commission stipulated that a plan for refunding the notes at maturity and for other permanent financing should be presented.

IT is reported in Chicago that the Linde Air Products will be consolidated with the Union Carbide Company.

AMERICAN Gas and Electric Company reports for 1913: Gross earnings, $3,811,292, an increase of $472,522, net, $1,025,715, a gain of $109,276, and surplus, after charges, $680,303, $64,034 greater than 1912. After payment of $9,690 preferred dividends, there remained a balance of $580,613, equivalent to 16.69 per cent. on the $3,500,000 common stock.

UNITED GAS IMPROVEMENT COMPANY for 1913, reports net profits were $7,471,107, or the equivalent of 13.47 per cent. on the $55,502,950 capital stock, compared with $7,524,691, or 13.56 per cent. in 1912. The total earnings were $8,613,194, a decrease of $1,875. Expenses amounting to $1,142,087 increased $51,708. The total earnings last year included $7,314,968 from leased works and investments, $1,060,806 from sales of securities, $177,999 from interest and $59,420 from miscellaneous.

AT a meeting of the Old Colony (Mass.) Gas Company held this week, it was voted to increase the capital stock by an issue of 1,000 shares of Preferred and 1,000 shares of Common at 100 in accordance with the recent authorization of the Board of Gas and Electric Light Commissioners. This will make the authorized capitalization of the Company as follows:

Bonds	$338,000
Preferred Stock	354,500
Common Stock	354,500
Total	$1,047,000

At the present quotation of the stock the Rights have a value of $1.00 to $1.25.

GAS STOCKS.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

MAY 11.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co	$99,816,500	100	133¼	133⅛
Central Union Gas Co.—				
1st 5's, due 1927, J. & J	3,500,000	1,000	101	103
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S	1,000,000	1,000	101	104
Mutual Gas Co	8,500,000	100	157	157
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	99	101
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	59	62
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98¼	100¼
New York and East River—				
1st 5's, due 1944, J. & J	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J	1,500,000	—	98	100
Northern Union—				
1st 5's, due 1927, J. & J	1,250,000	1,000	100	102
Standard	5,000,000	100	102	104
Preferred	5,000,000	100	93	94
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	90	95
The Brooklyn Union	15,000,000	1,000	126	128¼
1st Con. 5's, due 1948, M. & N.	15,000,000	—	102	103
Yonkers	299,050	500	180	—
Out-of-Town Companies.				
Am. Gas & Electric	—	100	81	84
Preferred	—	100	48	49
Am. Light & Traction	$12,302,400	100	345	350
Preferred	14,238,200	100	101½	103½
Am. Power & Light	5,661,400	100	62	64
Preferred	3,106 800	100	81	83
Am. Public Utilities	2,995,000	100	45	50
Preferred	3,914,000	100	72½	75
Chicago Gas Co. Guaranteed				
Gold Bonds	7,860,000	1,000	104	106½
Cincinnati Gas and Electric				
Co.	39,500,000	100	67	69
Cities Service	15.7 8,700	100	87	90
Preferred	27,368,400	100	73	74
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus Gas Light & Fuel				
Cmpany	1,633,753	100	65½	66½
Preferred	8,026,500	100	33	35½
Consolidated Gas Co. of N. J.	1,030,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Denver Gas & Electric	7,000,000	100	91	93
Detroit City Gas Co	6,580,000	—	—	80
Electric Bond & Share	3,500,000	100	—	—
Preferred	3,500,000	100	93½	100
Federal Light & Traction	4,750.000	100	20	22
Preferred	2,500,000	100	71	71
General Gas & Electric Co.	2,000,000	100	3	8
Preferred	1,300,000	100	55	60
Hudson County Gas Co	10,500,000	100	—	—
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	98½	99